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ORDINARY MEETINGS.

Wednesday Evenings at 8 o'clock.

MARCH 15.—"On Marine Engines from 1851 to the present time." By N. PROCTER BURGH, Esq., C.E.

MARCH 22.—"On the Preservation of Food, especially Fresh Meat and Fish, and the best form for Import and Provisioning Armies, Ships, and Expeditions." By G. C. STEET, Esq.

MARCH 29.—"On Window Horticulture, and the Cultivation of Plants and Flowers in Cities and Crowded Localities." By JOHN BELL, Esq.

CANTOR LECTURES.

The concluding lecture of the Second Course, the subject being "The Applications of Geology to the Arts and Manufactures," by Professor D. T. ANSTED, M.A., F.R.S., will be delivered on Monday evening, at Eight o'clock, as follows :—

MARCH 13TH.—LECTURE 6.—On Metalliferous Veins or Lodes and their Contents, and on the Extraction of Metalliferous Minerals from Lodes.

These Lectures are free to Members (without ticket), and every Member has the privilege of admitting ONE Friend to each Lecture.

Proceedings of the Society.

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CANTOR LECTURES.

SECOND COURSE.—FIFTH LECTURE.—MONDAY, MAR. 6.

IRONSTONE AND COAL.

Professor ANSTED first pointed out that iron and coal were the chief sources of material wealth, and that Great Britain was especially provided with these minerals. The circumstances under which iron ores and mineral fuel are found, the extent of the deposits, and the way in which they may be obtained, were the subjects to which he would now direct the attention of his audience. Iron is widely disseminated, and forms part of almost every substance with which we have to do. But although thus common, the ores are not universal. In most of them iron is in combination with oxygen. These include magnetic iron ores, specular iron ore, red hæmatite, and micaceous iron, and numerous hydrates, called brown hæmatites. There are also spathic iron, brown spar, and clay ironstone. Silicates and phosphates of iron are also sometimes used. The richest ores are the protoxides; the next the peroxides; and the least rich, but most abundant, the carbonates, or rather the carbonates of the oxide. The phosphates are sometimes rich in iron, and the silicates also. The former are chiefly worked in Canada; the latter near St. Maurice, and in the Canton of the Valais, in Switzerland. The sulphides are valued only for the sulphur they contain. Magnetic iron ore is a rare mineral in England. It is diffused in the old rocks, but is not abundant. The chief supplies are from Norway, Sweden, and Russia. The central portion of the island of Elba is of this material. Important veins of it exist in India and the East, in North America, in Mexico and in Brazil. It contains, when pure, 72 per cent. of iron. The hæmatites are more common with us than magnetic ore. They are rich in iron, but it is more profitable to mix them with the poorer ores than to use them alone. There are two kinds; one yielding, theoretically, 69¼ per cent. of iron, and the other 56 per cent. The ores are rarely free from foreign substances. The crystalline are either specular ores, micaceous ores, or oligist. The earthy ores are opaque and red, whence the name "hæmatite," or blood-stone; but when containing water, this colour passes into brown. They are valuable for smelting. They are also used for polishing; and some varieties are employed as pigments. The carbonates of iron, yielding from 20 to 45 per cent. of metallic iron, are sometimes crystalline, as in sparry iron, but more often earthy, as in the common ores of most parts of England. They form the group of clay ironstones. The chief mines of hæmatite in England are at Ulverston and the neighbourhood of Whitehaven. at the bottom of the limestone in contact with slate. At Todholes, near Cleator, this ore is worked as a quarry. The floor of the deposit is a white and red mottled shale of the limestone series, almost a fire-clay, and 40 feet thick. The surface of the shale is uneven, and is covered by white quartz pebbles. Then comes a magnificent bed of hæmatite, from 15 to 30 feet thick (sometimes as much as 60 feet), subdivided by irregular joints. Bands of greenish-black shale are interstratified with this ore. It is difficult to say whether the ore is a contemporaneous deposit. It is extracted in the manner adopted in the case of coal, and the quantity removed is large. Besides these mines, the same ore has long been worked from the carboniferous limestone of Low Furness, in a deposit resembling a chasm or vein, and at Dalton, under similar circumstances. Curious dishshaped deposits of hæmatite exist in the same neighbourhood. Some of these are 50 yards in width, and 20 yards deep. The ore in them is only covered by drift. The ore is fine and crystalline. From one point you may proceed 400 to 500 feet in either direction in one solid mass of this valuable substance, and its bottom has not been reached. Other hæmatites are from Derbyshire, the forest of Dean, Somersetshire, and South Wales. Those of the forest of Dean seem almost inexhaustible. The coal measures are equally rich in clayey iron ores. They are impure, earthy, and carbonaceous minerals, among which iron oxide is present to a large extent. The clay ironstones are black, blackish-brown, yellowish-brown, pale yellow or drab. They are sometimes regular bands and sometimes groups of nodules alternating with coal bearing deposits. In the Bradford districts (Yorkshire) there are groups of bands near the bottom of the coal measures: the upper group contains five bands, which are valuable though not pure. They contain 36 per cent. iron oxide and 25 per cent. carbonic acid, besides nearly 20 per cent. of silica. In Derbyshire the ironstones are numerous, and they yield from two to six thousand tons per acre. The most remarkable is the "Black shale," of Stavely, near Chesterfield. It consists of two groups: the upper containing nine, the lower twelve seams, half an inch to 1½in. in thickness. The Shropshire and North Staffordshire coal-fields yield some excellent qualities of ore adapted for making the best kinds of iron, but the quantity per acre is not large, nor are the ironstones rich. In the Potteries coal-field the ironstone bands are in the upper part of the field, agreeing with South Staffordshire and North Wales. The ironstones of these districts include the *black bands*, originally worked in Scotland. In South Wales, the coal measures form two series, the lower containing the great bulk of the iron bands. These may be followed across the Bristol Channel to Ireland, but are there poorer than in Wales, yielding an average of less than 20 per cent. Scotland is exceedingly rich in similar ores. Within a few years enormous deposits of iron ore have been obtained from the Cleveland Hills, in the east of Yorkshire. On the coast there crops out a thickness of fifteen feet of ironstone, containing an average of 30 per cent. of metallic iron, but, unlike an ore, resembling an irony sandstone, its surface deeply rusted. It occupies the position of the marlstone in the middle of the lias formation, and extends over a region of some hundreds of square miles, thinning out towards the south. The supply must be regarded as practically indefinite, and it is obtained with extreme facility. Its yield at one point near Eston, has averaged 50,000 tons per acre. and the available ore per acre would average 40,000 tons, yielding 10,000 tons of metallic iron. In France, also, the oolitic rocks are partly made up of rich ores and of iron, the ores being earthy and not easily recognised, except by those who trust to analysis instead of appearance. The value of such ores is about equal to that of English oolitic ores, the general average being about 30 per cent. The most remarkable beds of ore are in the centre of France, not far from coal. Belgium and Germany are not less rich in valuable ores than France; but they are not always available for the manufacture of iron, as, without fuel, the richest iron ores are of little value. The value of ironstone depends much on the supply of fuel at hand, and thus the ironstones of the coal measures, though not rich, are important; while it is only from accident that other ores possess the value now attributed to them. In the north of Europe, where there are forests, and cheap labour, charcoal iron may be made of the pure ores of these countries; and in India, smelting can be carried on to advantage in small furnaces, but these are exceptional conditions. The methods of obtaining iron ore vary according to the position of the ore, the magnitude of the deposit, and the presence of other useful minerals. In the lias and oolites, the ores are removed by digging or quarrying. In the coal measures they are raised with the coal. The system of bell pits is adopted where the ironstone nodules of the lower coal measures come close to the surface. There are small shafts arranged in great numbers on the line of strike at a distance of a few yards from each other, and in the Forest of Dean the ore lies in open spaces in the limestone, called "churns," or "pockets." In mining it is cut away, leaving natural pillars. The contents of the deposits vary, both in quality and quantity, and the result is a picturesque irregularity, strongly contrasting with the monotonous galleries of coal mines. To utilise the poorer ores of iron, admixture of other mineral is needed in the furnace. This is called a flux. With the common ores limestone is a flux. The richer ores can be reduced at once with charcoal in small quantities; the great operations of iron smelting are confined to those countries where the claystones and limestone abound, and where there is also an abundant and cheap supply of mineral fuel. Everything thus resolves itself into a question of coal. Where there is coal other things are at hand. When coal is absent other mineral wealth is comparatively useless. Too much attention cannot be given to the history of mineral fuel, that we may know where to expect deposits and how to obtain them. There are many varieties of mineral fuel differing in their properties and in the circumstances of their occurrence. I do not include among coal the shales which simulate coals, and are sometimes reckoned as part of them, but only the coals strictly so called, namely, the anthracitic and bituminous varieties and lignites or brown coal. Some have no value for commercial purposes, but their carbon contents are all strongly marked, and the carbonates afford the best measure of their relative practical utility. Lignites are inferior to coals. They are irregularly distributed in rocks of the tertiary period. They are so far altered as to have a mineral aspect, but they retain a woody character. They exist sometimes in masses of enormous dimensions, but not in regular beds. In England they have no value, but in Germany there are important deposits. This kind of fuel labours under a great disadvantage. It contains water (at least 10 per cent.), which only is got rid of by drying in the air. Lignites contain much ash. Thus, when burnt, much of the heat is left in the conversion of the contained water into steam; and part is wasted on the ash. But lignites are not to be despised as fuel. They have been found available for manufacturing purposes, for iron smelting, for railways, and for steam-boats. In the valley of the Rhine, on the shores of the Baltic, and in Styria, are some of the thickest of these deposits, approaching 200 feet in thickness. The very best lignites may be detected on exposure. After a short time they change, and in a few months fall to powder. They must thus be brought into use immediately after coming out of the mine. Most of the newer deposits of mineral fuel are lignites. The exact reason of this is not clear. It was long regarded as an axiom in geology, that no coals were deserving of the name but the carboniferous period. Real coal exists, however, not only in secondary rocks, but in tertiaries. This is proved by the contents of a remarkable coal-field in the valley of the Zsil, in Transylvania. There, in tertiary sands, are regular seams of excellent coal, very thick, and standing every test. Chalk, the oolites, and the lias also contain coal. In England the Kimmeridge coal is a rich bituminous shale. The Brora field possesses two seams, worked by pits sunk 80 or 100 yards. The coal is bituminous, and burns to a white ash. The Whitby coal has been worked more than a century, and is of fair quality. There is excellent oolitic coal on the Danube. One deposit is at Fünfkirchen, not far from Pesth. Though poor in appearance, and powdery, this coal burns well, with flame and much heat and without much ash. The Ovavicza coal is inferior to the Fünfkirchen, but supplies the Vienna and Basiasch railroads. Asiatic coals are chiefly from oolitic rocks. There are five coal districts—three in Northern India, one in Cutch, and the fifth on the coast of the

Burman empire. The coal is associated with limestones, clays, and ironstone bands. The South African coal is from rocks of the same age. A large tract in Eastern Virginia contains valuable oolitic coal, worked near Richmond. There are three seams, one of them 30 or 40 feet thick; the total thickness about 30 feet. The coal is adapted to the manufacture of gas, but varies in different parts of the field. The great coal fields of England, of Belgium, of Spain, of France, and of North America, besides those of Bohemia, Moravia, and the Rhine, of Russia and China, and probably of Australia, belong to the Palæozoic rocks. The coal-fields of Great Britain range from Somersetshire, in the south, to Ayrshire, Lanarkshire, and Fifeshire, in Scotland, in the North. There are four principal groups of deposits, distinguished as the Northern, Eastern, Western, and Southern. These again are subdivided, and we have, in a different order, the following coal-fields:—(1) the Newcastle coal-field, (2) the Cumberland and Westmoreland coal-fields, (3) those in the West Riding of York, (4) the South Lancashire coal-field, (5) the Flintshire coal-field, (6) the great Yorkshire and Derbyshire coal-fields, (7) the North Staffordshire, (8) the Coalbrook Dale and other Shropshire coal fields, (9) the Worcestershire coal fields, (10) the Leicestershire, (11) the Warwickshire, (12) the South Staffordshire, (13) the Forest of Dean, (14) the British and Gloucestershire group, (15) the South Welch coal-field. In Scotland, in the valley extending from the Firth of Forth to the Firth of Clyde, we have (16) the Clyde Basin, (17) the Ayrshire coal-field, (18) the Lesmahago Basin, (19) the Clackmannan coal-field, (20) the Fifeshire, (21) the Lothians, and (22) the Dumfries. All supply bituminous coal and some also yield cannel coal, steam coal, or anthracite, and all are liable to faults of all degrees of magnitude, and every variety of condition. The faults are sometimes mere interruptions of continuity, but sometimes wide gaps filled with stones or rubbish. There is no doubt of the vegetable origin of coal; but it still remains a mystery how coal was formed, or what combinations were necessary to produce it. In most cases it represents a mass of vegetation that must have taken many years, or a large area, to accumulate, but yet in some instances there is proof that it must have accumulated rapidly. It seem to have accumulated near the mouth of large rivers or low swampy flats. Bituminous coal is brittle, burns with flame and smoke, and gives off gas on dry distillation. It contains from 10 to 30 per cent. of volatile substances, and leaves a residue of coke. Caking coal is a variety which runs together in the fire. Cannel coal, or parrot, is compact, does not soil the fingers, and can be sculptured. It burns like a torch or candle, with much light and smoke, and contains from 40 to 60 per cent. of volatile substances. Steam coal is a hard semi-bituminous coal, with little volatile matter, but burning freely with flame and much heat. Anthracite is free carbon, homogeneous, and with conchoidal fracture. Some varieties are powdery or flaky; some resemble graphite. The Newcastle coal-field (1) has been the most extensively worked of any. Till lately it yielded bituminous coals and cannel, it now also yields excellent steam coal. Its coal is valued for household use, and it makes the finest coke. No anthracite has been found here. The area occupied by coal contains about 700 square miles, and is divided by a great fault crossing the whole field from east to west, the strata being lowest on the northern side of the fault by ninety fathoms. There are no important bands of ironstone. There are forty seams in the Newcastle field, but only eighteen are workable. The most valuable is two yards thick. The total thickness of workable coal is eighty feet, and the mean thickness of workable coal four yards. Some of the best seams are worked out to a considerable depth. Estimating the area of 450,000 acres, the average thickness at four yards, and the weight of the coal at one ton per cubic yard, the field would contain eight thousand millions of tons of coals. The Whitehaven field yields valuable coal. Its extent, with two other small fields adjacent, is 100,000 acres. There are seven workable seams, the thickest of which is eight feet. They are worked under considerable difficulties, and at great depths, sometimes beneath the sea. The coal is good and caking. The South Lancashire coal-field (4) supplies the vast population concerned in the manufactures carried on in that part of the kingdom. The coal occupies an irregular area. It is found not only in the coal measures, but in the millstone grit, and the whole area includes a thousand square miles of strata. Many of the coals are thin, and the sections are unequal. In one direction there are 75 beds of coal in 2,000 yards of measures, the total thickness of coal being 150 feet. In another direction there are only 26 seams, though the total thickness of coal is 90 feet. The thickest bed is ten feet. The quality is good. There is excellent cannel worked near Wigan and elsewhere, particularly valuable for gas. The available coal has been estimated at 4,000,000,000 tons, but the evidence is very imperfect. The sinkings are not deep, and the quantity of water is not excessive. The Flintshire and Denbighshire coal-field (5) is smaller and much worked. There are five workable seams, of which one is nine feet thick. The total thickness of coal is nearly 40 feet. Among the beds is a cannel, called curly cannel, extremely rich in hydrocarbons. The Yorkshire coal-field (6) supplies many large towns in the north of England. The number of seams is not large, but one of them is ten feet thick. and there more than thirty feet of workable coal. The quality is excellent, and the pits of moderate depth. There are also very numerous bands of ironstone. The North Staffordshire or Pottery coal-field (7) contains a number of good seams of excellent coal. Here there is forty feet thick of coal, in twenty-four seams, one of which is ten feet thick. With the coals are ironstones. The South Staffordshire coal (12) is brought up by faults through the new red sandstone. It has one seam, called the "ten yard seam," exceptional among the English coals. In other countries are many beds of coal that bear the same proportion to this that the thick coal of Staffordshire does to the six-foot coals of Newcastle. The Forest of Dean has been less worked than some, but is of considerable importance. Near it, in Gloucestershire, is another small coal-field. Near Bristol there is an extensive and important coal district, now much worked, and yielding a large supply of excellent fuel. We come next to the great South Welsh coal-field (15), which includes 900 square miles. It is divided into three unequal parts; the west anthracitic, the middle steam coal, and the east bituminous. With the coals is ironstone; generally thin, but of good quality. The thickness of coal is 70 to 100 feet. Although the estimates of the total quantity of coal are exaggerated, it is the largest and most important in the British islands, and its resources will be available long after the smaller coal areas of the north have been exhausted or rendered unworkable. The Scotch coal-fields are both numerous and rich. Most of the coals are dry, free burning, but not caking. They belong to the lower members of the carboniferous series, and are older than the English coals. The total area is 1,600 square miles. Coal has been long worked in Scotland, and the total quantity raised amounts to 12,000,000 tons. An important part of the Scotch coal is made use of for distillation, to obtain paraffin oils. Ireland has coal-fields, both bituminous and anthracitic. The former are small, but the coal is abundant. The anthracitic deposits are more numerous and more worked than the bituminous. The coal of Munster is the most developed. Belgium is rich in coal, and the province of Hainault, the western division of the coal-field, is very remarkable. Every variety is found there—from pure anthracite, burning without flame, through the rich bituminous kind called "*Charbon gras*," making excellent coke, to the flaming coal or cannel called "*Fléau*." The most valuable of all is called "*Charbon maigre à longue flamme*." France possesses a very large number of small coal-fields. Those in the northern departments are portions of the Belgian coal-fields, and contain the same varieties of coal. In the eastern part of the country, as at Saarebrück, on the Moselle, there are others of the same nature. In the interior the most important are in and near the Basin of the Loire. In central France there are numerous small basins, in some of which the thickness of the coal is extraordinary. At Aubin there are 124 yards of solid coal in eight seams, one of which measures fifty yards at its outcrop. In Rhenish Prussia the basin of the Ruhr, near Düsseldorf, is the seat of important coal mining operations, and the Saare coal-field extends from France into Germany. The chief German coal-fields are those of Bohemia and Silesia, Moravia and Galicia. The total yield of bituminous coal from the Austrian empire in 1860 was about one and a-half million tons. Some of the rivers of Russia, and some localities on the shores of the Black Sea yield good coal. The Iberian peninsula is very rich in coal. In the Asturias, there is a coal area of very large dimensions, containing upwards of a hundred workable seams, varying from three to twelve feet in thickness. In the south of Spain, in Portugal, and near Barcelona, there are workable coal seams. There are coal seams almost within the arctic circle. North America contains coal-areas, compared with which the richest deposits of Europe sink into insignificance. The chief are the coal-field of the Alleghanies, including the basin of the Ohio and the coal-field of Illinois, the basin of the Missouri, and the coal-fields of Nova Scotia, New Brunswick, and Cape Breton. The Alleghany coal-field measures 750 miles in length with a mean-breadth of 85 miles, and traverses eight principal States, among which are Virginia, Pennsylvania, Ohio, Kentucky, and Alabama. Making a liberal deduction for unproductive portions, denuded strata, and unattainable depths, there are 25,000,000 acres of valuable coal-field. The coal is partly bituminous, partly anthracitic, and the seams numerous and convenient. The Illinois field includes the Indiana district, where a rich bituminous coal extends over an area of 8,000 square miles. There is another great coal-field in Missouri. British America supplies coal in New Brunswick, Nova Scotia, and Cape Breton. The New Brunswick beds are thin. Nova Scotia is extremely rich, and contains one seam of thirty-four feet of good coal, besides others of ordinary proportions. The coal is excellent. South America contains coal on the coast of Brazil. China and Japan possess mineral fuel extending down the eastern side of Australia, where coal has been long worked. The Chinese coals were worked at least six centuries ago, both anthracitic and bituminous. New Zealand contains coal. Borneo has large deposits. The methods adopted to obtain coal constitute the practice of mining; they vary according to the position of the coal, the thickness of the seam, the nature of the rocks above and below, the quality of the coal, and the quantity of gas it gives off underground. The quantity of water also enters into consideration. If coal crops out on the side of a valley, it can be got readily, and at small expense, by levels or galleries tunnelled into the side of the hill. Coal, however, being rarely horizontal, a gallery, following the dip of the coal, will incline down-hill on one side and up-hill on the other side of the valley. In the first case any water that enters will escape, but in the other it will accumulate. The coal also can be run out readily in the one, and must be drawn up-hill at some expense in the other. Thus, it is only when coal is horizontal or dips towards a valley, that crop workings can be carried on with advantage. In the other case it will be better to sink a pit and obtain the coal by running a drift from the bottom of this pit. Crop workings are confined to the early workings on a seam. Coal at its outcrop may sometimes be obtained by quarrying when the seam is thick, and retains its quality as a useful fuel after long exposure to the weather, but in England such workings have long ceased to have much value. Among the more remarkable open workings is one at St. Etienne, near Lyons, in France. When underground works are to be reached by a pit or shaft, it becomes a matter of importance to know whereabouts, at what depth, and in what state the coal lies. Where the outcrop is known, the dip of the coal regular, and the coal not faulted, this is not a difficult task. But the permanent inclination of a coal seam is not always the same as its dip at the outcrop, and faults must not be left out of calculation. Better ground for an opinion than calculation is therefore necessary, and boring must be resorted to, that we may learn the general relations of the beds and the depth to a known point in the series, after which calculation is easy. Three borings are necessary where the coal is not already proved, and its outcrop is not clearly known. Several are required when there is reason to expect faulted ground. When all is known that can be made out concerning the circumstances under which the coal lies in any given property, the next operation is to sink a shaft to intersect the bed at a certain depth, so that all that is possible of the coal seams of the district may be worked. Great experience is needed to decide this point. On the one hand, if the pits are too deep, unnecessary expense is incurred, not only at first, but afterwards, in getting as well as reaching the coal, and in lifting the water. On the other hand, if they are so placed as not to be able to remove the coal from the extremity of the estate, that portion will be lost; for after expensive pits have been sunk, and much of the coal got, it will not be worth while to get the rest by a fresh sinking. So with regard to faults, if the pits be sunk without reference to them, great difficulty may be experienced and heavy expenses incurred that might be avoided by greater knowledge of the ground. When coal is being got from near the outcrop, it is usual to sink many more shafts than when the mine is deep. The enormous cost of deep shafts justifies this economy, but there are both disadvantages and great dangers in mines that are carried on by a single shaft or by shafts too far apart. In the event of an accident, either to the shaft or in the ventilation, communication may be entirely cut off, and thus a heavy loss of life may result. Thus the determination as to the number and position of the shafts is a matter to be very carefully considered. In shallow mines, the pits are generally single and of moderate size. In deep mines, they are in pairs, or one very large shaft is divided into three portions. A shaft or shafts being decided on, the work of sinking commences. The rocks through which the sinking has to pass will some of them be water-bearing beds, and would supply strong springs, if that were the object of the sinking. If water is reached while sinking, it must be shut off; if it come in at the bottom, it must be pumped out. The only way of shutting it off is by lining the shaft with an iron casing passed down as the sinking proceeds. The bottom of the shaft is the coal seam which it is intended to remove. When the coal is reached, and there are two pits, these are immediately connected, partly for ventilation, and partly for the convenience of further workings. One pit should be free, and serve as a chimney for carrying off the air, which is injured by the breathing of the men, or by emanations of gas from the coal. During the sinking of each pit, if more air is wanted than naturally comes down, the shaft is divided into two portions by a partition, and ventilation is effected by artificial means. If there is a pair of pits close together, they are usually sunk on the line of dip of the beds, so that one shall reach the coal at a greater depth than the other. In this case a natural ventilation sets in, one shaft acting as a chimney to carry heated air up, and the other as a pipe down which the heavier air descends. When coal is reached, a drift or tunnel is carried on it in the direction of the strike. In the case of a pair of pits two such drifts are cut, one from each. This enables the field to be laid out conveniently, and reveals the condition of the coal, the state of the roof, and the continuity of the seam. Along these roads the coal when removed can be drawn. Along the lower drift, or by the side if there is a single pit, the water of the mine is conducted, and when there is a pair of pits, the lower of the two drifts is called the water-gate, and the upper the horse-gate. At right-angles to such drifts, and on the rise of the coal, another gallery is driven, called the winning headway, or, in Yorkshire, the main board-gate. If there be a second shaft at a distance, it is convenient that this should communicate with the winning headway. The further working of the mine may be carried on either by the pillar and stall or the long wall method. The former is adopted in the Newcastle coal-field, and has been introduced with modifications into many other districts. The latter is that followed in the coal-fields of Yorkshire. In the Newcastle coal-field, where the coal lies deep, where there is much water, and where shafts are costly, and the coal full of gas, it is found convenient to divide the coal property into a number of panels, or divisions, kept separated by a thickness of forty or fifty yards of coal. Each panel is worked independently, beginning with that most distant from the shaft. Levels are driven at right angles to each other, leaving large pillars of coal to keep up the roof, till the whole panel is laid open. When such galleries have been completed the pillars are attacked, carrying away as much as possible, supporting the roof for a time with wooden pillars, and ultimately removing the pillars, and allowing the roof to fall. The farthest panel being removed, the next may be attacked, and so on till the work is completed. In Yorkshire, where the depth is less and the coal harder, with faults less troublesome, the long wall method is adapted. By this, drifts are run through the coal from the main board gate parallel to the winning headway, and the coal is left in a number of long walls supporting the roof. When the mine is thus laid open, the walls are entered by small cross drifts, and the greater part removed, and the roof allowed to fall. In coal mines, there is a cause of difficulty and danger arising from the light carburetted hydrogen gas existing in the coal and emitted under ground, especially where the coal has recently been broken. Besides this fire-damp, choke-damp, or carbonic acid gas, is not unusual. Both have to be provided against by ventilation, and thus the conveyance and distribution of air is essential in laying out a coal mine. Mixed with atmospheric air, this light gas, when exposed to flame, explodes, leaving after explosion carbonic acid gas and a small quantity of water. When a large quantity of gas issues from coal, and mixes with the atmospheric air carried down for ventilation, as soon as the proper mixture is obtained the light from an open candle would explode the whole, leaving behind a poisonous, heavy gas, which must inevitably choke those who have not already suffered by the explosion. By the ventilation of mines, dangerous mixtures of gas should be rendered as unlikely to occur as possible, and, by a safe method of lighting, the danger, when it exists, should be avoided. But perfectly safe ventilation and a perfectly safe light are not easy to find, and accidents still occur from neglect of proper precautions. The ventilation of mines is conducted by producing a strong draught up one shaft by means of a fire at the bottom, or by exhausting the air by steam or other means at the top. All the air entering the mine by the other shaft or shafts is forced to take a course through the workings, and along the levels, before reaching the up-cast shaft. Extreme care and attention is needed to ensure the ventilation being adapted to the issue of gas, and to avoid a dangerous mixture. But a safety-light is needed, even where the ventilation is most perfect and best looked after. Such a light was provided in the Davy lamp, and it is theoretically perfect if the explosive gas in the mine be light carburetted hydrogen, and if due caution be used. This lamp is a common oil lamp, covered with a metallic gauze, so open that little light is intercepted, but so close that flame cannot pass. The gas poured into a mine from certain kinds of coal, or from empty spaces met in working coal, is sometimes large in quantity, and issues with so much force as to overcome all efforts to render it safe by mixture with atmospheric air. In such mines there is a constant singing heard, especially where the coal is newly broken. In such case the use of the safety-lamp is necessary, if indeed it is right to carry on work at all. Gas accumulates in old workings, and when these are reached, either in continuing the works of the same mine, or in any other way, there is great danger. Many of the worst and most fatal accidents have happened in this manner. When coal has been removed the roof will fall, or if supports are left, the pressure on the floor will drive that up. There must thus in all neglected works be a vast pile of broken rock in which great open spaces are left, and in these the gas becomes stored. Such a pile is called the "goaf," and the depression that appears at the surface when the roof of a mine is fallen is called "creep." These are a few of the many points that suggest themselves in reference to the practical geology of coal-mining.

FOURTEENTH ORDINARY MEETING.

Wednesday, March 8th, 1865; Lieut.-Colonel J. P. Kennedy in the chair.

The following candidates were proposed for election as members of the Society:—

Newcombe, Cornelius Prout, 16, Barnsbury-villas, Liverpool-road, N.
Perkes, Samuel, West Dulwich, S.
Scott, Colonel, R.E., Ealing, W.
Tanqueray, Arthur Charles, Hendon, Middlesex, N.W.

The following candidates were balloted for and duly elected members of the Society:—

Giles, Francis, 42, Blomfield-road, Maida-hill, W.
Phillips, Major Thomas Scott, 10, College-crescent, Finchley-road, N.W.
Savile, Edward B., 30, St. George's-road, Pimlico, S.W.
Spriggs, William, 10, York-row, Kennington-road, S.
Templetown, Major-General Viscount, C.B., Government House, Devonport.
Walker, Micajah Hilditch, 13, St. Swithin's-lane, E.C.
Warden, J. William, Warwick Cottage, Park-village East, N.W.
Yardley, Vincent, 3, Thorney-street, Bloomsbury, W.C.

The Paper read was—

ON THE GINNING OF COTTON.

By Zerah Colburn, Esq., C.E., Memb. Inst. Civil Engineers.

It was for a long time the habitual boast of the planters of the Southern States of America that "Cotton was King, that it ruled England, and that they, the planters, ruled cotton." The American civil war itself was in some measure due to this delusion. In renouncing Federal authority the Southern people, then unprepared for war, were almost unanimous in the belief that England would interpose, either by diplomacy or by arms, as might be necessary, to prevent any interruption in her supply of cotton.

In 1860, when our total consumption of this great staple was 1,083,000,000 lbs., exceeding that of any previous year, five-sixths of that supply was drawn from America. Last year we consumed but 561,000,000 lbs., or about one-half as much as in 1860, and of this less than one-twelfth was drawn from the once United States. In other words, nineteen-twentieths of the American supply has been lost to us, and with the failure of the recent negotiations for peace and with the certainty of the overthrow of American slavery, no one can pretend to say when any portion of this loss will be recovered. At present the mills of Lancashire are mostly supplied from India, the larger proportion of Indian cotton being grown in the Central and Western provinces, and shipped from

Bombay. The virtual monopoly which the Indian cultivators now enjoy cannot, however, be said to have resulted either from the force or the policy of British rule in the East. Nor is India as well suited as some other countries to the growth of good cotton. The indigenous staple is of inferior quality, and the country needs irrigation before a good return can be had from exotic seed. It has been rather our necessity, and the growing commercial influence which this country exercises in India, that has brought forward such large supplies upon such short notice.

Previous to the American war, no country in the world could have competed successfully with the Southern planters of the States in the growth of cheap and excellent cotton. In 1849, the quality known as fair New Orleans was as low as $4\frac{1}{2}$d. per pound in Liverpool, and it averaged no more than 6d. for a series of years. The Mississippi low lands will produce yearly from 250lb. to 500lb. of clean cotton per acre, or nearly five times as much as in the best cotton districts in India. The American planter is his own landlord, and beyond the interest on the cost of his farm and of his slaves,—the latter cultivating crops for their own food also—his labour costs him next to nothing. Before the war he was lightly taxed, even under the indirect taxation of a protective tariff upon articles of consumption imported from abroad. The American cotton country, too, is intersected by great navigable rivers, affording the cheapest possible means of communication by steamboats and by barges. Added to this, the staple of the American, or more correctly, the Mexican seed cotton (which is of that quality known as New Orleans) is sufficiently strong to bear the action of what will be presently described as the saw gin, a machine for separating cotton from its seed at the rate of from two to seven bales per day. Hardly any other than the Mexican seed cotton will bear the saw gin, and hence, heretofore, no other staple could as a rule be so rapidly and cheaply ginned. As gathered from the shrub, the fine filaments of cotton are firmly attached, at one end, to a hard but oily seed, not quite so large as the kernel of a filbert. This seed is covered with cotton on all sides, and the value of this depends upon the length, fineness, strength, and colour of the filaments. These are flattened, twisted tubes, with no joints; whereas the filaments of flax are cylindrical, jointed tubes. Cotton fibres vary in diameter from the $\frac{1}{1000}$th to the $\frac{1}{1800}$th of an inch, or about one-third the diameter of fine human hair. Their length varies greatly. Inferior cottons have a staple not longer than $\frac{5}{8}$ths of an inch; the New Orleans middling variety is about $1\frac{1}{4}$in., while the very fine Sea Island cotton sometimes reaches a length of $2\frac{1}{4}$in., or even more. The short-staple cotton grows from a greenish-coloured seed, which, even after ginning, has a woolly surface, while the finer cotton, as the Sea Island, has a smooth black seed, from which the filaments are easily detached. Of a given weight as it comes from the field, only from one-fourth to one-third is cotton, the remainder being seed. From their great comparative weight, if for no other reason, the seeds must be separated from the cotton at the place of growth, as otherwise the cost of freight to market would be tripled or quadrupled.

It would be an intolerably tedious process to pick the cotton from the seeds by hand labour. Not much more than one pound of clean cotton, or lint, as it is always called on the American plantations, could be thus separated per day. From a very early period, however, the Hindoos have cleaned their seed cotton by passing it between a pair of smooth wooden rollers revolving nearly in contact with each other. This machine is known as the churka, and is still used in India. The rollers, by their revolution, draw the filaments of cotton between them and thus away from the seed, upon which, from its size and hardness, the rollers cannot bite. Smaller rollers of steel, fluted with fine grooves along their length, so as to increase their tractive force upon the filaments of cotton, are still made and used to some extent in separating Sea Island cotton from its seed.

The word "gin," as applied to machines, is a contraction of the word engine, and the churka is undoubtedly the most ancient cotton cleaning engine or gin in existence.

On the conclusion of the American war of independence in 1781, the people of the Southern States of the new Union turned their attention to the cultivation of cotton, for which the then increasing use of Arkwright's spinning machinery had already created a considerable demand at high prices. With a rich soil and congenial climate, and with the economy of slave labour, crops to almost any extent could be cheaply raised. But the separation of the cotton from the seed presented a great difficulty. Hand labour for this purpose was even then out of the question, while the churka, known in America as the roller gin, was so ineffective that two or three days' work of even forty slaves, each employed in feeding and turning a gin of this kind, would result in but a single bale of clean cotton, often the produce of but a single acre of land. Each slave labourer will cultivate cotton to the extent of five bales yearly on the uplands of Georgia, and from ten to fifteen bales on the lowlands, but it would require the constant work of the same labourer, at a churka, for nearly three months to separate even one bale of clean cotton from the seed. At the Royal Exhibition held last year at Turin, a large number of cotton gins, of all kinds then known, were carefully tested for quantity and quality of work. Among them was a churka made and in considerable use in Italy under the name of Manganello. With a pair of $\frac{3}{4}$in. wooden rollers 8 in. long, worked by one man at the rate of 89 revolutions per minute, only six ounces of cleaned Siamese cotton were turned out per hour, and probably not more than half a pound per hour from like gins could have been counted upon by the American planters in the last century. The Sea Island and the upland cotton were first planted in the States in 1789, but many planters who thus commenced soon abandoned this branch of culture. It happened at this time that a Yankee schoolmaster, Eli Whitney, then resident in the family of an influential Southern planter, had his attention directed to the then great want—that of a machine or gin for quickly and cheaply separating cotton from its seed. Whitney hit upon a revolving circular saw, as the most effective instrument for the purpose. Not that the saw acts by incision, as in its common application with wood, but its teeth, which are filed to the form of sharp conical claws, seize hold of and pull away the cotton from the seed, the seed being held back by the fixed sides of a narrow opening through which the saw is made to revolve, much as a circular saw, in wood working machinery, revolves between the sides of a narrow slit in the saw-bench. It is a little doubtful whether Whitney, at that time, had seen a circular saw in use for cutting wood, but had he done so, the whole idea of his gin might have been caught from such a saw at work. With a saw shaft once in revolution, it was evident that a number of saws might as well be mounted upon it, each working between the sides of its own guard, for stopping the seeds, and thus, it would be right to suppose, the effect of the machine would be directly as the number of saws employed. Whitney understood this, and he fixed a considerable number of saws at short intervals upon a single shaft, and these worked with but little clearance at their sides between the bars of a kind of a gridiron, or grid. A revolving cylinder with projecting brushes was added to clear the cotton from the saw teeth after it had been drawn through the grid. Whitney completed his invention and patented it in 1792, and it is impossible to say how much the cotton trade now owes to his simple and effective contrivance. The early machines turned out 300 lb. of clean lint per day, while at the present time a gin of sixty or seventy nine-inch saws, driven by steam at a speed of 180 to 200 revolutions per minute, will deliver 3,000 lb. of clean cotton in twelve hours, an amount about equal to the average yearly crop cultivated by a single slave labourer. As an inventor, Whitney's fame in the States is co-extensive with that of Fulton, and his tomb, at New Haven, Connecticut—modelled after that of Scipio, at Rome—bears a glowing eulogy to his genius.

When we consider the exceedingly delicate character of loose filaments of cotton, it is a matter of wonder that they bear the discipline of the saw gin at all. Indeed, it was soon found that the fine Sea Island cotton was cut to pieces in saw ginning, as the long-stapled Egyptian cotton, if it were tried, would also be. It is to the credit of the American or Mexican "Orleans" and Georgia staples that it does bear the saws. Other cottons, however, do not possess the same strength and elasticity. The indigenous Indian, Chinese, and Turkish cottons will not bear the saws, and they require careful treatment in any process of ginning. On the occasion of the International Exhibition of 1862, Mr. Wanklyn, a well-known Lancashire cotton spinner, sampled and valued all the cotton exhibited. Much of it had been spoilt—literally chopped to bits—in ginning, and a still larger quantity had been more or less injured, so as materially to lessen its value. The difference between good and bad ginning, as applied to the case of the whole present Indian cotton supply, would amount to a difference of between six and ten millions sterling in value yearly.

The American or Mexican cotton may be grown elsewhere, however, than in America. Its seed has been transplanted in Brazil, in India, and in some other countries. The New Orleans seed was introduced into India in 1842, by Mr. A. N. Shaw, the collector in the Dharwar district of the Bombay presidency. At one time the result was reported a total failure, and this report appeared under Government auspices. It is the fact, however, that Dharwar cotton, of all others in India, is the most extensively cultivated, while it brings also the highest price. It is believed by many that the New Orleans seed has degenerated since its introduction into India, yet Dr. Forbes Watson's reports show that much of the Dharwar cotton has a staple of from $1\frac{1}{4}$in. to $1\frac{1}{2}$in., and, in some cases, even $1\frac{7}{10}$in. long, and of a very fine quality. All the Dharwar cotton is saw-ginned, after the American practice, and it is believed to be the only Indian-grown cotton that will bear the saw gin. Dharwar, although in the Southern Mahratta country, and near the Madras Presidency—in fact, not many miles to the eastward of the Portuguese colony of Goa —is commonly reckoned, in respect of its production of cotton, with the district supplying what is known as Surat cotton, or Surats, from the port of that name to the northward of Bombay. "Surats," in Lancashire, has become a term indicative of everything bad, from beer to theology. Indeed, one of the Manchester newspapers, not long since, incurred and lost an action for slander, in consequence of the unintentional admission of an advertisement, in which the produce of a firm of brewers was spitefully nicknamed "Surats." Much short, yellow, weak-stapled cotton, filled with leaf and stones, has undoubtedly been shipped under this name from Bombay to England; but the Dharwar cotton deserves a different classification. With proper means of communication it is probable that the cotton of the Dharwar and other districts of the Deccan will be yet shipped from the new port of Sedashagur, nearly half-way between Bombay and Beypoor, the latter being the western terminus of the Madras railway.

Without entering fully into the moot question whether exotic cotton will thrive permanently in the East, it is nearly certain that the Dharwar, or transplanted staple, is the only one now in India which can be saw-ginned without much loss by cutting, and without the formation of knots or "neps" of fibres, which sadly try the fine teeth of the carding engines, and which if once produced in ginning, will infallibly cause the production of lumps in the yarn. The American cotton has this advantage, also, in favour of the grower: with a given crop of seed cotton, requiring a given amount of labour in its cultivation, from three-tenths to one-third are obtained as clean lint, whereas nearly all other short-stapled seed cottons give one-fourth only of their weight in lint. In other words, the American seed, on Indian soils, gives nearly one-fourth more clean cotton, for the same acreage and labour, than any of the indigenous sorts.

The Macarthy gin, as it is named from its Irish-American inventor, who produced it about thirty years ago, was designed for staples that are too tender to bear the saw-gin. Its action is at once simple and unique, and it may be described as that of rubbing the fibres from the seed, or, more strictly, pulling them from the seed by a rubbing process. The construction and action of the Macarthy gin will be better understood, perhaps, from a familiar illustration than from drawings and a technical description. The roller of a jack towel, revolving nearly but not quite in contact with a kitchen wall, will convey the idea very closely. And, without wishing to make out a case for the interference of the Society for the Prevention of Cruelty to Animals, a Skye terrier will serve as a magnified as well as animated representative of the seed, with its cotton growing from all parts of its surface. With so much suggested it is easy to understand how a mischievous boy would proceed to gin a favourite poodle, and if the poor brute were not fleeced, and possibly flayed in the operation, he would have nature and not his tormentor to thank for it. But if we pursue this illustration we shall see that, if the roller were sufficiently large and turned with sufficient force, it would "bite"—to use the technical term—not merely the hair but the dog also. So, instead of the kitchen wall, we will place the edge of kitchen shovel along the roller, so as nearly to scrape its revolving surface, this edge being presented not towards the centre of the roller, but tangentially to its circumference. If, now, we cover the towel roller with leather, so as to increase its frictional power, we shall have the Macarthy gin. The revolving leather-covered roller pulls the cotton through the narrow space which separates it from the fixed tangential blade, or "doctor," as it is called, and the seeds are kept back because they are too large and too hard to pass through. The action may be compared to that of the churka, although there is some difference. The advantage which the Macarthy roller has over the churka is that the former may be made of any convenient diameter, and thus its surface speed may be increased much beyond that of the small rollers of the churka; and, furthermore, as the larger roller has sufficient stiffness to prevent springing sideways in its work, it may be made of any convenient length—say, 20in., or even 40in., whereas, the churka rollers are seldom more than 8in. long.

In addition to the fixed blade of the Macarthy gin there is a second blade parallel with it, and put in rapid motion, so as to alternately overlap its edge, and thus to roll the seed cotton about, so that every portion of its surface may be fairly brought to the fixed edge of the "doctor." A grid is provided, of such width of opening that the seeds can only pass through it and escape after they have been completely stripped of their cotton.

Different makers have added various parts to the Macarthy gin, until, in some cases, it has become a complicated and a costly machine. One of these, in the International Exhibition of 1862, with a profusion of rollers, wheels, &c., representing an accumulation of alleged improvements, was said to turn out about 40lbs. of clean cotton per week for each inch of the length of the roller, or, say, 1,000lbs. of cotton for a 24-inch roller. The delivery of cotton depends upon the quality under treatment, and twice as much Sea Island, or even Egyptian cotton, could be ginned in a given time as could be turned out with Syrian or the shorter-stapled Indian sorts. At the Exhibition held last year at Turin, a large number of gins, of different kinds, and mostly by English makers, were tested with great care. The report of the Commissioners charged with the experiments gives the dimensions of the several gins, the speed at which they worked, the quantity and kind of seed cotton ginned, the quantity of seeds and clean cotton delivered, the temperature of the air at the time, the hygrometric state of the cotton, &c.; and also the power expended, as ascertained in the case of the steam-gin, by means of a dynamometer. The results were so widely various as to defy the application of any law; but it may be said that the very best, in the case of a gin with a single Macarthy roller, 5in. in diameter and 40in. long, worked at the rate of eighty revolutions per minute for only fifteen minutes, was at the rate of rather less than 22lbs. of cleared Italian cotton per hour. Another trial of the same gin, at the same speed, for eleven minutes, gave a rate of 18lbs. only of cleared cotton per hour. A gin of the same size, by another leading maker, and worked at the rate of 125 revolutions per minute for 14 minutes, delivered at the rate of $14\frac{1}{10}$lbs. only of cleaned cotton per hour. As a rule the shorter rollers—say, 20in.—gave a better result in proportion to their length, because, no doubt, the labour in feeding, being applied to a shorter distance along the roller, was relatively more effective. In one case a gin, with a $4\frac{1}{2}$in. Macarthy roller, 40in. long, driven, in successive trials, at the rates respectively of 73, 138, and 107 revolutions per minute, turned out cleaned cotton at the hourly rates, respectively, of $1\frac{4}{10}$ lb., 12 lb., and $8\frac{1}{8}$ lb. only. If anything like an average result could be drawn it was that the gins with a single Macarthy roller did not average over 5 lb. or 6 lb. of clean cotton per hour, at which rate it would take more than a week to gin a bale of cotton. The Macarthy gin does its work well so far as the condition of the clean fibre is concerned, and, were it not that its action is so tedious, and therefore so costly, a great aggregate saving would be effected by ginning even American cotton upon it. But this is totally out of the question, for if a penny or so per pound were thus added to the value of cotton, this would be more than lost in the greatly increased cost of ginning as compared with the saw gin. The Macarthy roller, too, is constantly wearing out, and has to be covered anew every few weeks, at a cost from £2 to £4. The leather frequently strips off at once from the wooden roller, and it is especially liable to deteriorate in hot countries. To avoid these difficulties finely-grooved iron rollers have been employed, the grooves running spirally around the roller. But these are not found to answer well, although they are, no doubt, very durable. In other cases rollers formed of circular discs of paper, compressed with great force upon each other, are in use, although here the frictional power or tractive force upon the cotton is less than that of leather. Indeed, the proverb appears to have held good, that "there is nothing like leather" for the rollers of the Macarthy gin. The tremor caused by the rapid movements of the vibrating knife, worked by a pair of short cranks, making from 500 to 700 revolutions per minute, is an objection to the gins now generally made upon the Macarthy principle. The vibrating knife, too, in many cases, interferes with instead of assisting the access of the seed cotton to the ginning roller. This was remarked upon in the case of several of the gins worked at the Turin Exhibition. Again the feeding requires constant attention, and, even at the best, it is irregular. The cotton cannot, of course, be expected to come off in an even fleece, like the thin and beautiful web from the doffer of a carding engine, but, very far from this, it ordinarily leaves the Macarthy roller in lumps and patches, falling irregularly both as to time and as to the length of the roller. Thus although the whole quantity ginned may be but little, too much may get through at one point, heating the roller to such an extent as to destroy the leather.

The last annual report of the committee of the Cotton Supply Association observed, as to the cotton gins, that "much yet remains to be done to provide what is urgently needed, to wit, a machine which, without injuring the staple as the saw gin often does, shall approximate to it in productive capability. Your committee regard this as a matter of vital importance to the cultivation of cotton." This opinion of the committee is that of every person well informed upon the subject. It is already a matter of much complaint that even the Dharwar cotton in India, the only kind grown there that will bear the saw gin, is being spoilt by the ryots who plant the indigenous and the exotic seed together, the result being a mixed staple, perhaps half of which is so injured in saw ginning as to render the whole nearly worthless. Whatever, too, may be the case of Indian cotton cultivation at present prices, anything like a return to those which prevailed five or six years ago will depend upon a very great improvement in gins. As applied to the prospective cotton crop of India, the advantage of a gin which, while nearly as efficient as Whitney's, shall make as good work as Macarthy's, may be valued at ten millions sterling per annum, or, if capitalised at ten years' purchase, to one hundred million pounds. This is but a practical and reasonable estimate of that which the committee of the Cotton Supply Association consider, to use their own words, "a matter of vital importance to cotton cultivation."

So long as ginning is a mechanical operation (and it has not been yet proposed to employ chemical agencies in the separation of cotton from its seed) so long must the staple be forcibly pulled from the seeds, which must be held back by the narrowness of the space through which the staple is drawn. The clawing action of the saws, the direct pull of the churka, and the rubbing pull, if the term may be allowed, of the Macarthy roller, would appear to exhaust all the modes in which force can be properly applied for the purpose to seed cotton. It is not certain what improvements, if any, can be made upon the saw gin. Certain modifications have been made, but the saws, to which all the injury to weak staples is attributable, are still the same in all gins of this class. A far more likely direction in which to look for improvement would be in that of the Macarthy gin, and here, it is not now premature to say, an improvement has been lately made which appears likely to raise this class of gins to the position contemplated in the extract quoted from the report of the Cotton Supply Committee. It is easy to see, on looking at a Macarthy roller at work, that a great portion of its surface, perhaps 40in. wide and running at the rate of 150ft. per minute, is altogether ineffective. Where something like an unbroken cascade of cotton should fall from it, it delivers in driblets. This scattered and patchy delivery proves that the appliances for feeding the roller are not what they should be; and this fact is a matter of course where constant hand feeding is required, as in nearly all the gins heretofore made of this kind. The travelling lattice and feed rollers sometimes employed do not act with anything like the effect on seed cotton that they do upon the cleaned staple in the opener, or the lap in the carding-engine. Seed cotton has very little cohesion in the mass, and it objects to march in close rank up to the sharp blast of the ginning roller. But by urging it forward, and distributing it continuously along the whole length of the fixed blade, the tractive force of the leather-covered roller may be increased, perhaps, four or five-fold beyond the ordinary rate. These objects appear to have been fully accomplished in the new gin invented by the gentlemen of the North Moor Foundry Company of Oldham, Messrs. Brakell, Günther, and Hoehl. In addition to the Macarthy roller and fixed blade or "doctor," they employ what is called a "knife roller," revolving in an opposite direction to the ginning roller, and at about four times the velocity. The knife roller, of which an example is shown, is a stout tube of gas pipe, with journals at the ends, and having upon it a number of discs or washers, placed obliquely to its axis. As the knife roller is rapidly revolved these discs not only draw the seed cotton into the ginning roller, but they distribute rapidly and alternately to the right and left along the edge of the "doctor." The knife roller is of the same diameter as the ginning roller, and the oblique discs or washers upon the former are from $1\frac{3}{4}$ in. to 2 in. apart, and have such an obliquity, with reference to the axis of the roller, that the whole of the seed cotton is rapidly traversed right and left along the doctor to about the same distance of 1¾ in to 2 in. From the form of the oblique discs the change from the right to the left-hand motion, and *vice versâ*, although made at very short intervals, is, nevertheless, gradual. The whole improvement consists in the application of the simplest possible means to produce a constant in-draught of seed cotton, and to distribute it constantly along the ginning roller, all parts of which are thus made to do their share of work. Instead of arguing, however, as to what the action of the knife roller ought to be, it is better to give the results actually obtained in practice. With a ginning roller twenty inches long the author has worked the knife roller gin with the following results:—At 152 revolutions per minute of the ginning roller, at which there was but the slightest heating of the leather coverings, the rate of cleaned Syrian short-stapled cotton delivered was 28lbs. per hour. Of African cotton, of a slightly better quality, the rate was 31 lbs. per hour. Of Egyptian cotton, with hard black seed, the rate was 45lbs. per hour. These rates may be taken as quite double that attained by any other gin of the same dimensions on the Macarthy principle. The seeds were very thoroughly cleaned, showing no waste; the fibre was not cut or torn in any manner, and, indeed, there was nothing to tear it. Nor was it at all knotted into those obstinate little entanglements which the Manchester spinners call "neps," and which, while they throw the teeth of the carding engines out of pitch and out of shape, and give, perhaps, fifty different diameters to a single yard of yarn, cause sad infractions of proper language among the spinners themselves. To turn out a large quantity of clean and uninjured cotton without waste is all that is expected of the best gin, and this the new knife roller gin undoubtedly accomplishes. It is, moreover, of extreme simplicity, having but three wearing parts—the ginning roller, the knife roller, and the "doctor," with but a single pair of spur wheels to gear the two rollers together. The usual objectionable cranks and rapid vibratory motions are altogether dispensed with. The gin is self-feeding, in virtue of the action of the knife roller, and thus a single attendant can manage a number of gins.

These results are confirmed by many of the leading mechanical engineers and cotton spinners of Lancashire who have seen the new gin at work, and the results stated may, therefore, be considered as accepted by those responsibly engaged in those branches of trade connected with the manufacture and working of cotton gins.

The makers of the knife roller gin have also produced what promises to be an improvement upon the Macarthy roller. Instead of a plain roller with a leather jacket, they have formed a compound roller of alternate discs of leather and malleable cast iron, the latter smooth on their circumference, but having corrugations on their sides near the edge. This roller appears calculated to exert a greater average tractive force upon the cotton, and to be more durable than the rollers now in use, and it is not likely from its action to injure the staple. Whether further trial should or should not fully confirm these expectations the novel and excellent action of the knife roller is not less established, and to this alone the great superiority of the new gin may be attributed.

Efforts are now making to grow cotton wherever it can be cultivated with the prospect of fair and good crops. As a great textile staple, cotton must be always in demand, and just as this demand is met so must the price fall until only a fair price is realised on the prime cost of production, with a due interest on the capital invested. As the price of cotton falls the relative importance of cheap and expeditious ginning will increase. With cotton as now at from 18d. to 2s. per pound for middling staples, even a penny a pound, as the cost of ginning, is not relatively large, but with anything like a return to 6d. per pound even ½d. for ginning would be a very serious item in the total cost. As one means of improving the general condition of the Indian cotton trade, therefore, and of enabling it to hold its own, permanently, against competition from all other sources, the author has brought to the notice of the Society of Arts what he believes to be the best instrument yet contrived for ginning cotton. When once this conviction is shared by this Society, perhaps no other agency than theirs could be more effective in making known the truth throughout the great cotton producing districts abroad. At the present juncture no subject is perhaps more worthy serious consideration on the part of the council and members of this Society—especially charged with the duty of encouraging the arts and manufactures—than that of the cheap and perfect separation of cotton from its seed—a matter upon which the permanent prosperity of the Indian cotton trade in a very great measure depends.

DISCUSSION.

Mr. Varley remarked that the comparison made by Mr. Colburn between the fibres of cotton and flax was incorrect. It was stated that the filaments of cotton consisted of "flattened twisted tubes, with no joints, whereas the filaments of flax are cylindrical, jointed tubes." He submitted that there was no joint whatever in the fibre of flax, the apparent joint being only a cross filament. Many years ago an attempt was made to "cottonise" flax by soaking it in alkali, and afterwards in acid; but the process damaged the material. Experiments he had made with filaments of flax, showed them to be neither tubular nor jointed, but quite solid. He believed flax to be the best material for the manufacture of cloth.

Mr. A. Nesbitt Shaw said, his name having been mentioned in the paper, he requested permission to say a few words on this subject. With respect to the question of gins generally, the first consideration was to adapt them to the particular kind of cotton on which they were intended to operate, as it was obvious from what was stated in the paper that the description of machine which was adapted for one quality of cotton would be injurious to another. Without going through all the different varieties of cotton, he would divide them generally into the two kinds of green seed and black seed cotton. Amongst the latter might be classed all the indigenous cottons of India. Hitherto they had been unable to introduce the better qualities of cotton into India without the aid of irrigation. These were perennial, and no doubt, with the aid of irrigation, would yield three or four good pickings a year. He considered if the Government of India had done its duty the better qualities of cotton would have been cultivated in that country to a very much larger extent. The New Orleans was the only exotic cotton grown in India as an ordinary crop; and in speaking of the relative commercial value of New Orleans and indigenous cotton, he might be allowed to quote a few sentences from a paper on this subject which he read two years ago before this society, in which he stated:—

> "New Orleans still maintained its position at the head of the price current, being on the 12th of November, 1862, 150 rupees per candy higher than the best cotton in the Bombay market. . . . Allowing that it requires seven acres of the New Orleans seed to produce a candy, or 784 lbs. of clean cotton, and that thirteen acres of the indigenous cultivation are necessary to yield an equal amount (the relative prices of the New Orleans and indigenous cottons being as quoted in Bombay at the above date, 560 rupees and 390 rupees per candy), the difference of the value of 280,000 acres of these respective cultivations, taking the rupee at two shillings, would be as £2,240,000 to £840,000, leaving in favour of the New Orleans £1,400,000, to be divided amongst those concerned in India in growing and selling the crop, and manifold more valuable to the Government and country than the whole aggregate of the expenditure which has been incurred in all the experiments throughout India."

Looking at this statement, it was obvious that the cotton to be introduced into India was the New Orleans; and in the South Mahratta district there were very nearly half a million acres of that cotton now under cultivation. It was well know that during the old time of the monopoly of the East India Company very little cotton came to this country from India. What they could acquire through their agents was bought up and sent to China in exchange for tea. They might have introduced every description of cotton into India if they had desired it, but under the monopoly of the East India Company they neglected to do so. After that monopoly was broken up, the manufacturers of Manchester took up the question, and frequently urged the East India Company to improve the quality of cotton grown in India, seeing that the trade had fallen completely into the hands of the Americans. Under that pressure the East India Company did what they no doubt conceived was right. They established large cotton farms in several districts, particularly in Dharwar, and they sent out some gins, in the first instance, for the purpose of cleaning the cotton. After several years of this experiment, in 1835, instructions were sent out to abandon the cultivation of New Orleans cotton altogether, and, as far as the Company was concerned, we should thus have been hopelessly condemned to the indigenous cotton of that country. This did not, however, satisfy the manufacturers of Manchester, and they resolved to make another attempt, and, accordingly, they sent to the United States, and engaged a number of Americans to go out to India; at the head of them was placed a military officer, not practically acquainted with cotton matters, and many of the rest were equally incompetent. In the meantime the experiments to which Mr. Colburn had alluded were undertaken. He (Mr. Shaw) took little credit to himself in the matter, but he was the first person who introduced the New Orleans cotton into India as an experiment, and it succeeded. After the first year he applied to the Government for assistance in extending the cultivation of that quality of cotton, but it was refused, on the ground that all the previous experiments had failed, and that it was useless to give further aid to promote that which they were satisfied would not succeed. However, the experiments went on, and the cotton was pronounced to be as good as any grown in the United States, but it was found that the old saw gin was useless for cleaning that cotton; a number of saws were sent out by the Company, and fitted up in rude machines by native blacksmiths. The only appliance previously was the native churka, a very rough instrument, and the only wonder was that cotton could be cleaned with it at all, except that the black seed cotton was hard and smooth, and easy to separate from the seed, but when applied to green seed cotton the fibre was greatly bruised and damaged. It was, therefore, necessary that there should be great improvements made in the mode of cleaning cotton in India. If India was to compete successfully with the American States in the growth of cotton, a quality of cotton such as that grown at Dharwar must be introduced. It was incredible the number of applications that had been made to the Indian Board for assistance in relation to this object. The aid required was not of a pecuniary character, but merely that the Government should place in each cotton-growing district of India men who thoroughly understood the cultivation of that plant, and who could induce the natives to act upon the advice given them, so as to make the New Orleans cotton popular amongst them. The reply to deputations on this subject invariably was, "It is not the duty of the Government to interfere; go to India yourselves and grow cotton there." He submitted it was emphatically the duty of the Government to interfere in this matter. Seeing that they had given a guarantee of five per cent. to an enormous capital expended in carrying out railway communication to India, for the purpose of opening out the resources of that country, was it too much to call upon them to promote the growth of cotton there? He contended the Government had lost the greatest opportunity they ever had of competing with the American States in the cultivation of cotton; and whenever the war in America terminated, India would fall back, in respect of the cotton question, into the position which it occupied ten years ago; but, on the other hand, if what had been done in the Dharwar district had been done throughout India generally, England at the present moment would have been independent of America for her permanent supply of cotton.

Mr. JAMES GARSIDE trusted that the forebodings of the last speaker with respect to the cotton question in India would not be realised. He (Mr. Garside) took a more hopeful view of the case. There had been some confusion in the use of the term Surat cotton. The so-called Surat cotton was grown in Goozerat, which was the district from which they might look for the main cotton produce of India. The bad name acquired by that cotton he believed was mainly owing to its unscrupulous adulteration, but that was not the fault of the gin employed. In India they had the native gin, the American gin, and the gin combining the recent European improvements. There was another machine employed by the natives besides the churka, the work done by which was excellent, though the process was a slow one. One great want of India was an efficient churka or hand gin, so as to afford employment to the large surplus female population of towns in India. The cotton question was now entering upon an entirely new phase. Up to the present time the profits of the cotton cultivation of India had been derived by the native agents rather than by the growers; and there could be no question that for the last three years great advantages would have been gained in every respect if the English manufacturers had been brought into more immediate contact with the ryots, so as to buy the produce directly from them instead of through native agents. The real secret, with regard to the cotton question in India, was the obtaining of a fair remuneration by the growers for their produce, and a permanent and safe market for it. That could be effected by no better means than by the establishment of some half-dozen substantial farms by Englishmen in the principal cotton districts. There was no difficulty in dealing with the ryots; and in proportion as good faith was established between them and the buyers, and as they were assured that there was a safe and permanent market for their produce, so would be the increase in the extent of cotton cultivation. In speaking of the peculiar adaptability of the Goozerat district for the growth of cotton, Mr. Garside remarked that the prevalent belief was that a great portion of that district was the base of an ancient fresh-water lake, containing vast deposits of vegetable matter. Here cotton was grown without artificial irrigation. A still more important matter than the gin, with regard to India, was the proper selection of the soil. Without that they could never get good staples. Looking at the specimens in the India Museum, the cotton was of better quality 150 years ago than it was at the present time. Formerly, Surat was the Liverpool of India with regard to the cotton produce of the country. The Indian ryot only required the certainty of the English market to stimulate him to the production of large quantities of cotton; but whilst they had the melancholy prospect held out in the speeches and writings of such men as Mr. Cheetham and Mr. Ashworth, that it was useless to think of growing cotton in India for the permanent English market, they could not hope that the vast resources of that country would be employed to anything like an adequate extent in that direction.

Mr. BAZLEY, M.P., would divide the few observations he should offer on this subject into two points; first, the necessity of obtaining a good quality of cotton; and, secondly, the necessity of its being well prepared for the market. His friend Mr. Shaw had given the meeting an account of the origin of the growth of the superior cotton of the Dharwar district, but Mr. Colburn had inadvertently fallen into an error in supposing that the chief part of the cotton sent to this country from India was of the Dharwar class; that class constituted only about one-tenth of the cotton that came from India. Of the great productiveness of that district in the cultivation of cotton, however, there could be no question. It would be, no doubt, a difficult task to overcome the prejudices of the natives in favour of the indigenous seed, and bring them to cultivate the superior quality of American seed, and in that respect undoubtedly good service had been rendered by the personal exertions and encouragement of Mr. Shaw. The native cotton dealers were in the first instance so prejudiced in favour of the indigenous produce, that it continued for a long time to command a better price at Bombay than the superior staple produced from the American seed; and it was not until the opinion of the English manufacturers was evinced by the larger price which the Dharwar cotton brought at Liverpool, that these prejudices were removed. It was gratifying to find that as the civilization of the people of India progressed under European government their long-retained prejudices were being rapidly removed. In no respect was this more apparent than in the matter of prejudice of caste. At the present day people of all castes travelled together in the railway carriages, where formerly they would not have been found in the same house together. It happened that the party of Americans Mr. Shaw had alluded to, as having gone out to India to improve the cotton cultivation, passed through Manchester, and he had the pleasure of showing them a fine crop of cotton plants, flowering, growing in an attic story of one of his large cotton mills. The production of cotton was not merely a question of seed, but also of soil and method of cultivation. The cotton plant required a loamy soil with an admixture of sand, with a looseness and moisture that would enable the roots to penetrate two feet into the ground. It was frequently planted on such hard soil that it could not obtain the necessary nutriment. A great many of the British colonies, such as portions of Australia, the West Indies, and some parts of our African possessions, were exceedingly well adapted for the production of large quantities of cotton. He thought it was a disgrace to us as manufacturers that we had allowed ourselves to remain so long dependent upon the slave-grown supplies of cotton from the States of America. About fourteen years ago, he had the honour of giving a lecture on this subject in that room, on which occasion the lamented Prince Consort did him the honour to preside, and he then called attention to the great danger of our reliance upon the fragile support of slave labour for our supply of this important staple. If the course indicated by Mr. Shaw had been pursued, no doubt by this time we should have been independent of the American States in this respect, and the amount of suffering which had been experienced in Lancashire would have been avoided. It was most important that the natives of India should understand that we want cotton of long fibre and sent to market in a well prepared state fit for the manufacturer's use. But the fact was the grower of cotton in India was not paid a price according to the quality of his produce. Good and bad qualities stood almost on the same footing; the cotton-grower therefore required to be taught the value of superiority of quality; and if he were made to understand that a higher price would be given for cotton of the staple of an inch than for that of a quarter of an inch, he would make efforts to supply that which was wanted. In all probability there would be a considerable re-action with regard to the cotton cultivation in India, upon the re-opening of the American supplies to this country, unless the system of cultivation in India was placed on a firmer and more satisfactory footing. He deplored the loss of opportunity by the Government of India in stimulating the production of the higher qualities of cotton at a time when the price of that article was so enormously high. Last year the amount of money transmitted to India by our manufacturers for the cotton produced there was, at the present high prices, so large that India was an important gainer by the transaction. If the price of cotton fell to its normal figure, India would be the loser to a considerable amount; but if the cotton was of that high class it might have been made, the loss would be greatly diminished, as the price would be higher. He had seen cotton of every class from India, and he believed they might have from the most generally useful class, which was New Orleans, up to the finest Sea Island—all the produce of India—if proper efforts had been made to obtain the cotton we want. With respect to the cleaning of the cotton, unless the article was good in itself, no mechanical operation would ever make it fit for the manufacturer's use. The Indian churka had, probably, been in use nearly 2,000 years, and it was a singular fact that the finest samples of Sea Island cotton from the American States were prepared by the roller gin, which was a machine very much upon the principle of the ancient Indian churka. The Whitney gin was applicable to short staples only. The length of the New Orleans was on an average only about three-quarters of an inch. It was not merely from the superior toughness of the New Orleans fibre that the saw gin did not injure it, but from the length of the staple, which permitted the teeth of the saw to pass over it without injury. The staple of Sea Island cotton was from 1¾ inch to 2 inches, and although the fabric was strong, yet if, owing to its length, it got into loops, the teeth of the saw tore these apart, and injured the staple to the extent, in his opinion, of 10 per cent., which, on a large crop of cotton, made a very serious item. For this reason he hoped to see the saw-gin superseded by the roller-gin. The Macarthy roller-gin was brought into this country, a few years ago, under somewhat curious circumstances. Some Sea Island cotton was sent over prepared by this gin. It had a most beautiful fleecy appearance, almost like a mass of snow, and he (Mr. Bazley) was so pleased with the condition of this cotton, that he wrote to his agent, at Charleston, to send him one of these Macarthy gins. In due time it arrived, and he had a number of them made by merchants in different parts of Lancashire. The machine now before them was an offshoot of it. By the aid of that gin he had no doubt there would be great economy in the preparation of cotton for the spinner, and the yarn made from that cotton was in many respects superior in quality. Economy in the separation of the fibres was of great importance. If 5 per cent, of cotton were left on the seed it was a loss equivalent to the amount they paid for cleaning the cotton. This ought not to be in itself an expensive operation. A good saw gin would produce 2,000 lbs. of cotton a week, worked with wind or water, and attended by a couple of negroes. The Americans were very clever in the use of the saw gin, and by ingenious modifications they had reduced the amount of injury to the fibre to a minimum. They wanted skill applied to the cultivation of cotton, and good machinery for cleaning it. There was one difficulty referred to connected with the introduction of large quantities of Indian cotton into this country—viz., that the English manufacturer could not place himself in direct communication with the planters. In America a different state of things existed, owing to the large number of agents employed there, to whom the criticisms of the manufacturers were conveyed, and by them transmitted to the planters; so that the English spinner could, as it were, almost bespeak the precise nature of the article he required. A striking contrast in this respect existed in India. As manufacturers they had no knowledge whatever of the cultivation, but if they could have agents to stimulate the growers to produce better cotton, he believed the regeneration of cotton cultivation in India would be accomplished. He was more and more convinced that the proper stimulus to all exertion—viz., a due reward for it—was all that was required to produce results alike beneficial to this country and to India.

Mr. Bishop mentioned that in travelling through Syria and the Holy Land he was surprised to find what a large amount of really good cotton was spoilt by the use of a gin even worse than that employed by the Chinese.

Having described the construction of that machine, he added that he had seen thousands of them at work in Syria. The great outcry in that country was to get a proper machine for cleaning the cotton; but it appeared that no European had ever introduced any improvements upon the primitive method still employed there. With respect to any improvement in the quality of the cotton, he learnt that one grower had been induced to try a better kind of seed, which he planted in a small patch by the side of the native cotton. He was highly delighted with the result, and for a long time kept the fact of his having this new seed a secret. The inquiry consequent upon a better quality of cotton was naturally for a better machine to clean it with. Throughout the whole district of Lebanon, to the river Jordan and the Dead Sea, the growth of cotton had greatly increased, and from inquiries he made he ascertained that the produce last year was sixfold that of the preceding year. He was persuaded that considerable quantities of cotton might be obtained from Syria, if proper means were taken for that purpose. With regard to quality, he believed it was of a description that would generally meet the requirements of our manufacturers, and that it could be sold at 7d. per pound, to yield a profit of 30 per cent. to the grower.

The Chairman said he was sure the meeting would cordially agree in a vote of thanks to Mr. Colburn for his valuable paper.

The vote of thanks having been passed,

Mr. Colburn, in acknowledging the compliment, said that although it was of the utmost importance to get a good supply of cotton, he regretted that on this occasion the discussion had tended almost entirely in this direction, and had not sufficiently referred to the best sort of gin for cleaning it. He thought, however, enough had been said by Mr. Bazley to show the importance of good ginning. looking to the fact, as stated by that gentleman, that 10 per cent. of economy was gained by the Macarthy machine, which, on the average amount of cotton supplied to this country, would amount to no less than £8,000,000 per annum. The only difficulty with respect to that gin was the comparatively small amount of work it turned out, but he believed the new gin, to which attention had been called, did its work quite as well as the Macarthy, at the same time producing a larger quantity of work. It was, in fact, the Macarthy gin with considerable improvements, and he believed it accomplished nearly as much work as the saw gin.

A collection of various forms of cotton gin belonging to the Society was on the table, and at the conclusion of the discussion, Mr. Colburn showed the operation of the new gin referred to in his paper.

Proceedings of Institutions.

Glasgow Institution.—The sixth annual report says that, although the directors cannot report an increase of students, there has been no decrease in the acquirements and progress of the students and scholars receiving instruction in the Institution. The numbers who attended each class during the year are as follows:—Mathematics, 26; free-hand drawing, painting, &c, 30; mechanical drawing, 38; practical mechanics, 21; Latin, 40; Greek, 12; French, 54; Gaelic, 5; grammar, composition, and logic (English history as exercises), 112; arithmetic and book-keeping, 141; writing, 29; geography, 4. Morning classes: — Arithmetic, book-keeping, &c., 23; phonography, 16; elocution and English literature, 38; music, 6. Elementary evening classes (males), 79; ditto, and domestic economy (females), 26; ditto, advanced (females), 19. Juvenile day classes, 223. Select day classes, 16. Advanced day classes: — Mathematics, French, Latin, book-keeping, &c., 13; free-hand drawing, 133; needlework, 27. From 20 to 30 per cent. of the above attended two or more classes. The number on the evening-class list was 623, on the juvenile day-class list 223. The total number, therefore, who have received instruction in the Institution during 1863-64 has been 846. The number of certificates and prizes awarded by the Society of Arts to students of this Institution during the last four years, show how meritorious has been the work of its students. Of the whole number who came forward only ten were rejected; indeed, the Institution stands among the first for having few rejected. During the same time the Local Board has awarded 274 certificates for qualifications in the various branches taught in the Institution—these are given instead of prizes. The directors earnestly impress upon the students the great value of whatever tests or attests their qualifications, especially the certificates of the Society of Arts. They are of opinion that, were the Society to authorise certain initials to candidates who pass a successful first-class examination in a stated number of branches, it would add greatly to the value of the certificates, and also be a more powerful stimulant to the acquirement of education. The financial statement for the past year shows that the class fees amounted to £303.

FRANCE AT THE DUBLIN EXHIBITION.

In all the more attractive and decorative classes of objects, there will be a fine display from France at the International Exhibition. The Emperor himself heads the list with a splendid collection of porcelains from Sevres, and tapestry from Gobelins and Beauvais. Promises have also been received from Barbedienne, of bronzes; Barbezat for iron-work, and Thenard for silver-work. Musical instruments will be exhibited by Alexandre, Saxe, and Herz; laces by Lefevre and Ferguson; silks by Berteaux, Brunet, Lecompti, and many others. Furniture and all the *articles de luxe*, for which Paris is the head-quarters, will be well represented. The French department of the Exhibition will be in one of the most advantageous parts of the building, and the exhibitors are sparing no expense to render this department attractive and ornamental.

Fine Arts.

Exhibition of Portrait Miniatures.—The following minute has been issued by the Committee of Council on Education:—My Lords read a memorandum on a proposed Exhibition of Portrait Miniatures prepared by Mr. Samuel Redgrave, and consider it desirable that the proposal should be carried into effect. The Exhibition will be opened at the South Kensington Museum, on the 1st June, 1865, subject to the usual regulations of the Museum as respects loans of objects. Several noblemen and gentlemen are to be requested to give their aid as a committee to advise their lordships on the subject. Mr. Samuel Redgrave is to be requested to undertake the special charge of carrying out this minute. The following are the particulars of the proposed Exhibition:—1. The miniatures which formed a section of the Loan Collection in 1862, were objects of so much interest that it is proposed to give a further development to an exhibition of this art, in which English artists were the first to excel, and which, though now seldom practised, flourished in England for nearly three centuries. 2. The Loan Collection comprised chiefly the works of our early miniaturists, Hilliard, Isaac and Peter Oliver, and Cooper (which were endowed with an antiquarian interest), with a few by Cosway, R.A., and some other artists. But the object of a second collection, though not confined to the productions of English miniaturists, should especially be to make a representative exhibition of their works, identified with their, in so many instances, almost forgotten names. 3. In seeking the assistance of the collectors and possessors of miniature art, they should therefore be particularly solicited to state, as far as it is possible to do so authentically—first, the name and titles of the person represented, and the date of the portrait; second, the Christian and surname of the artist; and third, the birthplace, date of birth and death (where not commonly known), with any other particulars that may prove of interest. A request should at the same time be made that such persons will kindly point out any other persons who possess miniatures which it is probable they will lend for exhibition. The collection might be completed so as to open some time in June next, and should include miniature portraits—first, in enamel; second, in oil and in water colours; third, in chalk or in pencil, whether drawn on vellum or paper, in plumbago solely, or in the latter manner with the face tinted. The following by no means exhaustive list, contains the names of many of the artists who practised in England, and whose works should be sought out and solicited for exhibition:—Miniaturists of the sixteenth century—Hans Holbein, John Bettes, Thos. Bettes, Nicholas Hilliard, and Isaac Oliver. Miniaturists of the seventeenth century—John Hoskyns, Peter Oliver, Samuel Cooper, Alexander Cooper, George White, Thos. Flatman, Alexander Brown, Thomas Sadler, Jean Petitot, William Faithorne, Sir Balthasar Gerbier, Richard Gibson (the dwarf), William Hassell, Sir R. Peake, Thomas Forster, Theodore Russell, Mary Beale, Penelope Rose, David Loggan, and Robert White. Miniaturists of the eighteenth century—John Dixon, Charles Boit, A. Plimer, Lewis Crosse, James Ant. Artaud, James Deacon, Bernard Lens, Thomas Frye, John Heens (of Norwich), William Blake, John Kitchingman, Thomas Worledge, John S. Liotard, Nathaniel Hone, R.A., John Cabaliere, Charles Macourt, John Alefounder, Alexander Pope, Thomas Redmund, Samuel Finney, Francis Cotes, R.A., Charles Sherriff, Miss F. Reynolds, John Foldsone, Michael Moser, R.A., Luke Sullivan, John Jackson, R.A., Christopher Richter, Christian F. Zincke, Mary Benwell, Bernard Artaud, Jarvis Spencer, William Roth, John Plott, Edward Dayes, A.R.A., John Donaldson, Henry Spicer, and Ozias Humphrey. Miniaturists of the nineteenth century—James Nixon, A.R.A., Mary Moser (Mrs. Lloyd), Samuel Collins, Samuel Shelley, Richard Cosway, R.A., Maria Cosway, Charles Muss, Henry Bone, R.A., Andrew Robertson, Alfred E. Chalon, R.A., Sir William Ross, R.A., F. Chinnery, and artists now living. It is hoped that possessors of miniatures worthy of note, either on account of the person represented or of the artist by whom the portraits were executed, will by their contributions give as much completeness as possible to the proposed exhibition, which both from an historical and an artistic point of view will be one of very great interest.

Manufactures.

Paper Material in France.—According to the returns published by the Director of Customs, the following is the weight and value of the rags exported from France during the last five years:—1860, 386,623 kilogrammes, value 354,649f.; 1861, 2,270,971 kilogrammes, value 1,249,934f.; 1862, 4,161,265 kilogrammes, value 2,288,696f.; 1863, 7,171,140 kilogrammes, value 9,040,579f.; 1864, 8,010,715 kilogrammes, value 10,809,606f. It might be presumed from these figures that France exported during the last two years a quantity of rags equivalent to 7 or 8 per cent. of the amount required by paper manufacturers at home, but such is not the fact. The Customs' returns comprise the drills, or woollen rags, which are not used in the manufacture of paper. When these are subtracted it will be found that the rags suited to paper manufactures exported in the year 1863 amounted to 2,877,801 kilogrammes, and the value to 453,901f.; and in 1864 to 2,820,868 kilogrammes, value 429,912f. The removal of the prohibition has not, consequently, deprived French papermakers of more than 3 per cent. of the rags they use. The French paper manufacturers have now resolved to petition the Senate to recommend the abolition of all duty on the export of rags, provided all other nations in Europe would do the same. The papermakers are likewise agitating in a more practical manner. They have established depôts in the less affluent quarters of Paris, such as the 18th and 19th arrondissements, where rags are sorted and washed. Persons employed to collect rags for these depôts will prevent the destruction of an article hitherto so much despised.

French Iron Manufacture.—In 1854 the quantity of pig iron made in France was 750,069 tons, of which 280,000 tons was charcoal-made. In 1863 the rate had increased to 1,180,000 tons, but the proportion of charcoal made was smaller, being only 280,000 tons.

Vegetable Flannel.—This fabric has for some time been in considerable demand on the Continent, and is used in place of ordinary flannel in the case of persons troubled with rheumatism and neuralgic pains, and of those especially whose skin will not bear the irritating action of woollen fibre. Vegetable flannel is a German manufacture, from the *Pinus Silvestris*. Its introduction is credited to M. Léopold Lairitz; and a large number of persons in the Black forests are now engaged in the various processes of separating the oil and the fibre, called *waldwold*, or forest wool, from the pine leaves, and of spinning, weaving, and knitting the yarn. As regards the hygienic qualities of the vegetable flannel, Dr. Hoppe, of the University of Bâle, and other scientific men, rate them very highly. Baths of pine leaves have long been used in Germany and Switzerland in cases of rheumatic affection, and the vegetable flannel is believed, like the baths, to have an immense power in establishing the functions of the skin when they have been interfered with by accidental causes. This result is attributed to the presence of formic acid—which creates a gentle and constant excitement of the skin—and of the tannin and resinous principles which are absorbed by cutaneous action, and supply the necessary elements for restoring a healthy condition.

Commerce.

Ostrich Breeding.—The problem of the domestication of the ostrich in the temperate regions of Northern and Southern Africa, appears already to be attended with satisfactory results; and instead of chasing the bird from its destination, in order to obtain the valuable spoils of its plumage, it can be bred and led to yield its feathers periodically for the wants of fashion. Some few years ago, it was stated that great success had attended experiments at the Jardin d'Acclimatation, at Hamma, in Algeria, the director of that establishment having received the premium of £80 offered by M. Chagot, sen., feather florist, of Paris, a member of the Commission of Valuers to the French Ministry of Commerce, who was the first to get the ostrich to breed in a domestic state; and the reproduction promises to obtain for commerce the ostrich plumes, which are daily becoming more rare and dear. At a recent meeting of the Cape Agricultural Society, M. L. von Maltitz, well known as one of the most enterprising and successful farmers in the Colesberg district, gave a statement of his short experience in ostrich farming; and any theory formed as to the profits which might be realised by such a pursuit falls immeasurably short of the result obtained. M. von Maltitz said: "My desire is that a prize be given to the proprietor of the largest number of ostriches in the district. I believe I am at present the only owner of those birds, and, therefore, I may, in making the proposal, be suspected of interested motives. To set that at rest, if a prize be offered and awarded to me, I will return it to the Society, to be again competed for at the following show. My sole object in moving the resolution is to encourage ostrich farming in the district, by which I am convinced, by my own short experience, enormous profits may be realised. Towards the close of last year, I purchased seventeen young ostriches of three or four months old. I placed them in an enclosure of 300 acres in extent, in which they had a free run. They have been kept there ever since, and have subsisted entirely upon the herbage of the enclosure, except an occasional feed of grain when driven up to the house for the inspection of visitors. I had at the same time other stock within the enclosure, and the opinion I have formed with reference to the extent of ground requisite for their grazing is that 35 birds can be carried year in and year out upon 300 acres of good grazing land —I mean land rather superior to the common run. At the end of last April I had the wings of the birds plucked, where the feathers of commerce grow. In consequence of the youth of the birds, these feathers then obtained were valueless. I now find, by recent examination, that the birds will be fit to pluck again at the end of the present month, verifying the statement made at the last Swellendam show by one of its members, who was, like myself, experimenting in this novel description of farming, that he obtained feathers fully grown from his ostriches every six months. My ostriches are so tame that they allow themselves to be handled and their plumage minutely examined. Being desirous of ascertaining the opinion of those versed in the trade, as to the commercial value of the feathers, I have had the birds examined by several, and the general opinion is that the largest feathers, of which there are twenty-four on the wing of each male bird, are worth £25 per lb., and that the yield of the whole plucking, the majority of the birds being males, will not fall short of £10 each upon the average. I think the statement made at the Swellendam Agricultural Show sets the value of each half-yearly plucking at £12 10s. per bird, and this, I have no doubt, will be the average of mine when they arrive at maturity, according to the present market value of feathers. The original cost of the young birds was about £5 each." In the last Cape papers it is stated that only a few small parcels of ostrich feathers had come to hand during the month, and for those offered at public auction competition had been very keen. All descriptions realised extreme prices, the best being sold as high as £27 10s. to £30 10s. per lb. In 1862 there was imported into the United Kingdom, chiefly from South Africa, Morocco, and France, 33,142 lbs. of ostrich feathers, valued at £76,256.

MEXICAN MINERALS.—Mexico is proverbially a mine of wealth, and one that has, in proportion to its richness, been but little worked. The new regime has given a great impulse to the search for available minerals, and a new find is announced almost every week; M. Rodriquez Sosa has opened up a petroleum well at Hacienda de Santa-Anna, in the province of Ernango; M. Ventura Alcerreca has found a white marble quarry in a small hill called Pescuay, in the province of Zumpango de la Laguna; and M. Hoefonse Lopez a deposit of bitumen in the department of Oajaca, near Port Angel, another to the north of Pochutla, a third on the bank of a stream called Cruz, and a fourth between Port Angel and the sea. Further, a new deposit of coal has been found near the village of San-Pedro, in the gorge of San-Andres, in the province of Ecatepec.

Colonies.

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AUSTRALIAN GOLD.—The quantity of gold dust imported into the Sydney branch of the Royal Mint, for the purpose of coinage, from the 1st of January to the 14th of October last, amounted to 599,223 ozs., and the coin issued was 2,225,000 sovereigns. For the same period of the year 1863 the receipts of gold dust amounted to 371,366 ozs., and the coin issued was 881,000 sovereigns and 556,500 half-sovereigns. Total value, £1,169,250. The increase in the business of the Mint is solely caused by the large quantities of gold received from Melbourne for coinage, and is not to be attributed to any improvement in the yield of the gold-fields. The following table will show the total amounts received and issued from the 1st of January to the 30th of September, 1863 and 1864, and the weekly receipts from that date to the 14th of October, 1863 and 1864:—

1863.	Sovs.	Half-sovs.	Ozs.
January to Sept. 30 ...	845,000	556,500	354,889
October 7	16,000	—	3,437
„ 14	20,000	—	13,040
	881,000	556,500	371,366
1864.			
January to Sept. 30 ...	2,186,000	—	570,645
October 7	—	—	14,114
„ 14	39,000	—	14,464
	2,225,000	—	599,223

TASMANIAN STATISTICS.—The population of the colony, by the census of 1861, was 89,973. The acres in cultivation in the whole colony, in 1863, were 267,173; of these, 139,321 are in the railway district. The value of the crops of 1863, in the whole colony, as given by the Colonial Secretary, was £934,915; the value of the crop, of the district, £427,430. The value of the live stock of the colony, in 1863, as published by the same functionary was £1,478,011, and of the railway district; £493,238. The annual value of the landed property of the colony, taken from the assessment rolls for 1864, was £675,000, representing a capital sum of £11,250,000, whilst the same property in the railway district was assessed at £237,187, representing, therefore, a capital sum of £39,531,000. During the four years ending December, 1863, it appears the excess of the imports over the exports, at Hobart Town, amounted to ££412,907; at Launceston, the excess was, of exports over imports, £416,409—a substantial proof of the commercial requirements of the northern districts, in regard to roads and improved means of locomotion. The yearly average of the customs' revenue collected during the same period was, at Hobart Town, £68,288; and at Launceston, £56,048; whilst the expenditure for civil service, exclusive of public works, has amounted to £105,900 per annum at Hobart Town, against £19,900 per annum at Launceston. The Crown lands sold in the railway district (with Devon) during five years ending December, 1862, amounted to 149,242 acres, for £194,416.

EMIGRATION.—During the past year there have been despatched, by the Emigration Commissioners, 30 ships with Government emigrants to Australia, and four to Natal. Of the Australian ships ten sailed for New South Wales, eight for South Australia, two for Victoria, seven for Queensland, and three for Western Australia. Seven ships were despatched from London, three from Southampton, seventeen from Plymouth, and seven from Liverpool. The passage money ranged from £12 10s. 6d. to £15 9s. 3d. per statute adult, and averaged, for Natal, £12 13s. 10d.; for Queensland, £13 1s. 4d.; for New South Wales, £13 3s. 4d.; for South Australia, £13 4s.; for Victoria, £14 1s. 11d.; for Western Australia, £14 5s.

NEW SOUTH WALES. — EXPORTS AND IMPORTS.—The exports from New South Wales for the year 1863 were valued at £6,936,839. The imports were valued at £8,319,576, showing an excess of £1,372,637. Rather more than half the imports came from Great Britain. From the colonies, produce to the value of £2,672,069 was imported, and from foreign countries to the value of £1,106,022. More than six-sevenths of the trade, therefore, in this respect was carried on within the limits of the British Empire. Of the exports England received £2,287,357, the colonies £4,459,101, and foreign states £109,381. The reason why exports to the other colonies figure so high, is, that the export to Ceylon, consisting mainly of gold, was valued at £1,906,983, and the exports to Queensland amounted to £1,070,895, which includes the exports re-exported coastwise. Next to the United Kingdom the highest imports are from Victoria, and these also represent an intercolonial trade. Queensland comes next in the list; then South Australia, from which breadstuffs are received. Of foreign countries, Manila received the largest sum of money for sugar and cigars; next came China for tea, and next the United States for a variety of commodities. There is very little sold to these foreign countries in return. The live stock imported seaward into the colony was valued at £20,176 The live stock exported seaward was valued at £109,821. This latter branch of business was more flourishing than in any previous year, and was due to the demand that sprang up in New Zealand. Preserved meat was imported to the value of £38,503, and exported to the value of £35,649. The imports of 1863 fell below those of the previous year by a little more than a million sterling, but they were above those of any previous year by nearly as much. The exports fell below those of the previous year by about £160,000, but they were above those of any year previous to 1862. The whole course of trade, therefore, of the year, exhibited some signs of slackness. The most decaying branch of trade was with the fisheries, the imports from which amounted only to £9,431, while in the previous year they reached £27,608, and in 1856 were as high as £39,020. The total value of the export of wool was £1,828,000, which was a higher amount than had been reached in any previous year. The export of tallow was valued at £31,221, which was only about a third of that of the previous year. The timber import was valued at £88,832, and the export at £42,190. The value of the coal exported was £220,181, and the quantity was 298,038 tons. Both in value and quantity this was somewhat below the standard of the previous year.

Queensland Cypress Pine.—Among the other timber products of this district may be mentioned the tree called cypress pine. Of a peculiarly fine and handsome grain, it promises to supply the want much felt there of timber suitable for household furniture, sashes, doors, and interior fittings of houses, while its scent is reported as equal to anything in rose or sandal wood. The tree, which has usually a tall, straight stem, averages a foot in diameter, and splits readily for either slabs or shingles. Few persons appear as yet aware of the existence of this tree, the nearest stock at present known being over twenty miles from Clermont, in the direction of Peak Vale. It is hoped, however, that in the event of cypress pine possessing the properties attributed to it, its proximity may soon be turned to profitable account.

Queensland Sugar.—Some very excellent sugar has been grown and manufactured at the Victorian Cotton Company's plantation. It is said to be worth £40 per ton.

Obituary.

Mr. Henry Blundell, of Hull, died January 29th, 1865, aged 75. Born in 1789, and educated at Lincoln, he crossed the Humber, and after an apprenticeship with the late Mr. William Thomas, in Church-street, Hull, he commenced business there in 1810, and founded a branch of the colour trade in that town, which is at present represented in every important capital in Europe, and fast extending over the world. Under his management the "green" paint manufactured at the establishment has attained such celebrity that the name of the maker is almost invariably associated with the colour. In another branch of trade in which he was engaged—that of seed crushing—Mr. Blundell was the means of effecting improvements of a most important and enterprising character, which have conduced in no small degree to the prosperity of Hull. He applied hydraulic pressure to seed crushing, and was mainly instrumental in raising the machinery to its present state of perfection; the strongest testimony to the soundness of the principles by which he was actuated consists in the universal application of hydraulic power in the trade of which he was the most prominent member. As a man of business Mr. Blundell was universally respected; his liberality and promptitude earned for him the esteem of all men, and the respect of the 300 workmen who were permanently dependent upon him for support. Mr. Blundell had worked long and arduously as a public man; and was one of the oldest, if not the oldest, magistrate of the borough. He fulfilled the duties of the mayoralty in 1852, when the British Association visited Hull, and many members present at that scientific congress still retain pleasing reminiscences of his kindness and hospitality. Mr. Blundell's presence in the Town Council was instrumental in producing several important reforms. An ardent sanitary reformer, he devoted every effort to the amelioration of the social position of the working classes. To his energetic advocacy of the scheme, the public is indebted for the establishment of the baths and washhouses. Of the Infirmary and other local charities he was a liberal supporter. As chairman of the South Bridge Company, he has taken an active part in promoting a project which is likely to prove one of the most important local improvements of recent years. In the rifle corps, too, Mr. Blundell evinced great interest, and presented a valuable prize for competition during last season. He was elected a member of the Society of Arts in 1853.

Eugene Deveria, with his brother Achille (who died in 1857), once occupied a very prominent position in the artistic world of Paris. He had, however, lived for many years at Pau, but was struck down suddenly on revisiting the city of his birth, at the age of sixty years. His best known works are:—"The Birth of Henri IV.," in the gallery of the Luxembourg, which fixed his reputation; "The Reading of the Sentence on Mary Queen of Scots;" "The Death of Jeanne D'Arc;" "The Battle of La Marsaille," in the Versailles gallery; "The Inauguration of the Statue of Henri IV. at Pau, in 1846;" "The Death of Jane Seymour;" "The Four Henris;" and "Reception of Columbus by Ferdinand and Isabella," painted in 1861. He also painted a great number of portraits, amongst which are those of the Marshals Brissac and Crèvecœur, at Versailles. He also executed a ceiling in the Louvre, the subject being Louis XIV. and Puget; and the Chapel of St. Geneviève, in the Church of Notre Dame de Lorette. The brothers Devéria were at one time the leaders of the romantic school. The balls given in their ateliers were the most famous in Paris, and scenes which took place there have been delineated by more than one pencil. All the literary and artistic youth of the period appeared there in coats of mail, satin *justaucorps*, and every imaginable form of knightly, troubadour, and fancy costume. A celebrated art-critic of the present day is spoken of as once resplendent there in the character of Charles IX., and another in the bizarre dress of a poor scholar of Cluny in the olden time. From the atelier of the Devéria are said to have sprung the pointed hat, which, mounted above a luxuriant mass of hair dressed in the style of the Merovingian period, sent young Paris mad about the year 1830. This style of wearing the hair was called *La Perinet Leclerc*, and it was succeeded by another, entirely different, the almost shaved head, then named *coiffure à la mal content*, and later *au forçat*. In or about 1836 these eccentricities almost entirely disappeared, and the once famous leader of the romantic world, Eugène Devéria, retired to Pau, and became a Protestant clergyman, and was famous for the rapid, picturesque, and effective style of his oratory.

Alexander Fraser, A.R.S.A., died on the 15th Feb., at his residence, Wood-green, Hornsey, in the 79th year of his age. He was born in Edinburgh, on the 7th April, 1786. He studied at the Trustees Academy, where he, Sir David Wilkie, Sir William Allan, Sir John Watson Gordon, and David Roberts, were fellow-students under John Graham. With the two last named he had previously worked in the employ of Bengo, the Edinburgh house painter, before they became fellow-students. He then came to London, and commenced his profession as an artist. His pictures in the public exhibitions gained favourable notice. He became Wilkie's assistant, and during twenty years worked in his studio, mostly on the still-life details of Wilkie's pictures. During this period he was frequently able to exhibit original works of his own at the Royal Academy and British Institution, at which last exhibition he obtained the premium for the best picture of the year, with his "Naaman cured of the Leprosy." This success was followed by his being made Associate of the Royal Scottish Academy, of which he had been one of the founders, and by other honours tendered by his townsmen. Commissions from some of the best patrons of the day followed, and he soon occupied a distinguished position as a painter of *genre* subjects. His principal works were:—"Robinson Crusoe explaining the Bible to Friday," painted in 1836; and the "Interior of a Highland Cottage," painted for Mr. Vernon, and now at South Kensington. The subjects he chose were chiefly Scottish.

Publications Issued.

Eugene Delacroix.—Fac-Simile de Dessins et Croquis Originaux. Par Alfred Robaut. Printed at Douai.—A remarkable work, both as regards subject matter and execution. M. Robaut has well rendered the sketches of Delacroix, and his lithographic copies are as near fac-similes as possible. Not only are the strokes and touches given precisely as in the original, with here and there the notes of the artist attached, but the various colours and tints of black, white, and red chalk, sepia, pen-and-ink, and pencil, are reproduced with strict fidelity. The work is also well printed. The sketches are on folio paper, and the two series which have appeared at present include more than fifty sketches, or rather sheets, for in some cases there are more than one sketch on a sheet. Each sheet may also be purchased separately, at from two to four francs. The genius of Delacroix is so remarkable in his original sketches that these bear a higher value in proportion to his finished works than is usually the case. His daring male figures frequently call to mind some of those of Michael Angelo. Moreover, many of the sketches are the originals of ceiling decorations, which cannot be photographed, and are, in fact, much superior, in a purely artistic view, than the finished works.

Notes.

Portuguese International Exhibition.—This Exhibition of Arts, Manufactures, and Agriculture, inaugurated by the Oporto Crystal Palace Company, is under the patronage of his Majesty Don Luiz I. and the presidency of Don Fernando of Saxe Cobourg Gotha. It opens on the 21st August, and is to close on the 30th December. From the 5th to the 15th there will also be, in connection with it, an Agricultural Show of Plants and Animals. Medals and certificates of merit are to be awarded. Mr. Alfredo Allen is the Secretary at Oporto, and Messrs. W. H. Ivens and Son, Colonial Agents, Crutched-Friars, are the agents for the Oporto Crystal Palace Company in London, and will take charge of and forward goods, and represent parties there.

Exhibition at Nice.—A universal exposition of Horticulture, Industrial Culture, Acclimatation, and Scientific Collections, is to be held at Nice, about the 1st of May. Artistic and industrial productions will also be received. Articles may be sold at the close of the Exhibition. The Emperor gives two medals of honour—one to the foreigner or Frenchman who most contributes to the splendour of the Exhibition, and another to the inhabitant of the department (Alpes Maritimes) who does the same. The Empress of the French, the ladies of Nice, the Grand Duchess Helen of Russia, the Prince of Morocco, and Prince Oscar of Sweden, also offer prizes.

Dog Show in Paris.—A dog show is to be held in the avenue of the Cours la Reine, in the Champs Elysées, near the Palais de l'Industrie, from the 9th to the 14th of May next, under the direction of the Zoological Society. Persons wishing to send dogs are required to make known their intention by a post-paid letter to the Director of the Zoological Society in the Bois de Boulogne, previous to the 17th April. The letter is to contain the number, the breed, and the age of the animals proposed to be exhibited.

Cod Fisheries.—From the official returns relative to the French ships engaged in the cod fishery in the North Sea during the year 1864, it appears that the number of cod fish taken in 1864 was less than that in 1863—the weight in 1863 being 2,240,000 kilogrammes, and in 1864 only 2,048,000 kilogrammes. On the other hand, the take of flat fish was double in 1864 to that of 1863. There was likewise a very remarkable increase in the quantity of seal oil brought home. It amounted to only 16,000 kilogrammes in 1863, and increased to 112,000 in kilogrammes in 1864.

Locusts in Senegal.—The plague of these creatures has been fearful this season in the above-named country. Their ravages have been terrible, trees being stripped of the whole of their leaves, and shrubs and small plants being utterly destroyed. The total loss in the case of the cotton plant, which has escaped lightly, is estimated at three-fifths of the crop. In the experimental nursery grounds of the Taouey the cotton plants have been completely destroyed; not a leaf is left. To give some idea of the countless numbers of these insects, it is said that on the 19th of November last the steam dispatch-boat *Archimède* was moored opposite the nursery ground above mentioned, with the Governor on board, when a most extraordinary spectacle presented itself. A cloud of locusts, following the course of the left bank of the Senegal river from west and east, completely hid the land from view, like a thick curtain. The insects flew at the rate of about four miles an hour, and were passing from dawn till sunset, thus forming, as it were, a column from thirty to forty miles long; but, as at sunset the cloud towards the west was much more dense than at any other period, the inference was that what had gone by was merely the avant-garde. The unfortunate cultivators are in a state of despair, while the Moors, who do not trouble themselves with agriculture, console themselves by capturing immense quantities of the locusts, which they declare to be, if not the most agreeable, at any rate the most wholesome food that can possibly be imagined. It is the converse of the old proverb, "What is one man's meat is another man's poison," or, at any rate, destruction. The locusts eat up the poor farmer's crops, and the Moor eats up the locusts, or, at any rate, a few millions of them.

Supply of Water to Paris.—Few cities were worse supplied with water than Paris not many years since, and still the mode of supplying is primitive, dear, and inconvenient. There is no such thing in Paris, in the ordinary way, as a huge cistern or butt from which the pail may be replenished *ab libitum*. Great reforms are, however, being made in this matter; a water company is gradually carrying its pipes into private houses, and the common ewer is growing rapidly in size. The means taken for increasing the supply are grand, both in conception and extent; aqueducts, canals, and artesian wells are being excavated and constructed in all quarters of the outskirts. One reservoir at Menilmontant, which is rapidly approaching completion, has two stages, and is destined to contain 100,000 cubic mètres of water, at the height of 108 mètres above the level of the sea, and 35,000 cubic mètres in the other compartment at 100 mètres altitude.

At Belleville is another reservoir, also half finished; this is also divided into two parts, one to hold 15,000 cubic mètres, at the height of more than 134 mètres, and the other 25,000 cubic mètres, at an altitude of 131 mètres. At present one of the upper compartments is filled with Seine water raised by machinery at Charonne. The aqueduct for bringing the waters of the Dhuis to Paris is being carried on with great vigour; in the year 1863 sixteen kilomètres of canal and syphons were executed; last year ninety-six kilomètres; and only sixteen or eighteen kilomètres more remain to be accomplished, which it is expected will be done by the month of May. No work of the kind was perhaps ever performed more rapidly. Immense works are going on at Saint Maur for supplying a portion of the reservoirs and the lakes of the Bois de Vincennes; the subterranean conduits are terminated, the foundations for the machinery laid, and the buildings in hand. The lakes are expected to be supplied by these means with water from the Marne in May, and the supply of Paris with the same a month or two later. Two new artesian wells are being sunk; one of these has unfortunately fallen on a stratum of fine sand fifty-six feet thick, which has created great additional trouble, while the other has met with no serious difficulties, and is already finished down to the chalk deposits. In connection with these important works it will be interesting to give the price at which filtered water is sold by the municipal authorities to the water carriers, or other people who choose to be their own aquarii. According to a decree of the Prefect of the Seine, the price is 10 centimes for a hectolitre and a half, rather less than a penny for upwards of thirty-three gallons, and for a pailful one centime, or the tenth part of a penny. This decree came in force on the first of February.

Correspondence.

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CANTOR LECTURES.—WATER-SUPPLY FROM WELLS.—SIR,—I am much obliged to Mr. Homersham for his notes of the quantity of water supplied from wells in chalk and new red sandstones. Few engineers are better qualified to give such information. In my lecture, and in the abstract published in the *Journal*, I rather pointed out the quantity that might be anticipated from such rocks under ordinary conditions than the exceptionally large quanties yielded by particular wells. I believe I mentioned that such exceptions occurred. Allow me to take this opportunity of correcting an error in the abstract in the second paragraph of Lecture II., referring to the water-contents of sand. In the second column of page 218, line four, the word "ten" should have been *one*; and in line eight, for "ten," read *seventeen*.—I am, &c., D. T. ANSTED.

Athenæum Club, March 6.

VOLUNTEER FIRE BRIGADES.—SIR,—Mr. W. Roberts, in his letter which appeared in the *Journal of the Society of Arts* for the 3rd instant, "regrets to see his friend Mr. Young" getting into the track of underrating "the services of the regular brigade." Now, I beg to assure Mr. Roberts that I am not doing anything of the kind; that I fully appreciate the services of the regulars, give them every commendation for their exertions, and every credit for all they do; but I still maintain that they are perfectly insufficient for the work which is now required; that we have no right to ask or expect them to do it; and that we are doing wrong to leave the work to be done by those who have no obligation to perform it. As to his remarks respecting trained men, Deal boatmen, soldiers, life boats, &c., there is no necessity for a reply to them, for we know what has been done by less likely volunteers than these; but I still say, and it is constantly proved by facts, that far greater results have been, are, and will be, achieved by volunteers than by any *paid* men whatever; and if he says *paid* services are best, surely he cannot feel that he is acting in accordance with his convictions by commending and encouraging the services of a volunteer and *unpaid* brigade.—I am, &c., CHAS. F. T. YOUNG, C.E.

7, Duke-street, Adelphi, W.C., March 7th, 1856.

TAKING FISH BY SUBMARINE ILLUMINATION.—SIR,—On Wednesday, the 1st inst., I attended, by invitation, at the Society of Arts, to hear a paper on the above subject. The attendance was good, and the paper interesting. I was, however, much surprised at remarks that fell from the Chairman (Sir E. Belcher); and this feeling, I think, was general, from what I heard around me. The chairman opened his address by proclaiming the prejudices that he had against our fishermen making good seamen, from their liability to be sea-sick, &c. He then proceeded to relate his own surprising success as a fisherman, but could not be prevailed upon to explain the secret of it. The admiral's ideas were evidently those of the old school. I must, however, demur to his law, when he remarked that Mr. Fanshawe's patent "was of no value, as three miles out at sea it could be used with impunity." As well might the admiral say the same of Trotman's anchors, or any other patented marine invention. Probably the admiral also forgot that, unlike his own long cruises, fishing-vessels must, of necessity, frequently return to port; and the owners of those using Mr. Fanshawe's invention without his license would probably find it expensive to rely on the admiral's law with regard to patent right.—I am, &c., J. C. STOVIN.

Junior Carlton Club, March 7, 1865.

MEETINGS FOR THE ENSUING WEEK.

MON. ...Society of Arts, 8. Cantor Lectures. Professor Ansted, F.R.S., "On the Applications of Geology to the Arts and Manufactures." (Lecture VI.)
R. Geographical, 8½. 1. Capt. F. Galton, F.R.S., "On Stereoscopic Maps, taken from Models of Mountainous Countries." 2. Mr. James Fox Wilson, "On the Gradual Desiccation of South-Western Africa."
TUES. ...Medical and Chirurgical, 8½.
Civil Engineers, 8. Mr. J. W. Bazalgette, "On the Metropolitan System of Drainage, and the Interception of the Sewage from the River Thames."
Zoological, 8½.
Syro-Egyptian, 7½. Mr. B. H. Cowper, "A Philological Examination of certain Names of Places in the Old Testament."
Anthropological, 8.
Royal Inst., 3. Professor Hofmann, "An Introduction to Chemistry."
WED. ...Society of Arts, 8. Mr. N. P. Burgh, "On Marine Engines from 1851 to the Present Time."
Statistical, 4. Annual Meeting.
Meteorological, 7.
THURS...Royal Inst., 3. Professor Hofmann, "An Introduction to Chemistry."
Antiquaries, 8.
Royal, 8½.
Linnæan, 8. Rev. W. A. Leighton, "On Sir John Richardson's Arctic Lichens."
Chemical, 8. 1. Prof. Bloxam, "Action of Chlorine on Arsenious Acid." 2. Mr. J. A. Wanklyn, "Vapour Densities."
Numismatic, 7.
R. Society Club, 6.
FRI.......Philological, 8.
Royal Inst., 8. Mr. Balfour Stewart, "On the Latest Discoveries concerning the Sun's Surface."
SAT.......Royal Inst., 3. Prof. Marshall, "On the Nervous System."

PARLIAMENTARY PAPERS.

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SESSIONAL PRINTED PAPERS.

Par. Numb.

Delivered on 21th February, 1865.

51. Navy (Ships)—Return.
58. Navy Estimates.
Education—Revised Code of Regulations.
Education—Minute relative to Small Rural Schools and Evening Schools.

Delivered on 22nd February, 1865.

31. Bill—Union Chargeability.
3 (40 to 69). Railway and Canal, &c. Bills—Board of Trade Reports, Parts 40 to 69.
42. East India (Revenues)—Return.
Life Annuities—Tables.

Session 1864.

507 (A. viii.) Poor Rates and Pauperism—Return (A).
524. Local Taxations Returns—Return.

Delivered on 23rd February, 1865.

30. Bills—Capital Punishments within Gaols.
34. ,, Bankruptcy and Insolvency (Ireland) Act Amendment.
32. ,, Borough Franchise Extension.
36. ,, Industrial Exhibitions.
3 (70). Railway and Canal, &c. Bills—Board of Trade Reports.
27. Navy (Flogging and Marking) Returns.
48. Queen Anne's Bounty—Account.
65. Committee of Selection—First Report.
28. Court of Bankruptcy—General Return.

Delivered on 24th February, 1865.

33. Bills—Libel.
34. ,, Church Rates Commutation.
3 (71 to 78). Railway and Canal, &c. Bills—Board of Trade Reports, Parts 71 to 78.
37. Mint—Account.
41. East India (Loan)—Return.
46. Augmentation of Benefices—Summary of Return.
49. Metropolitan Improvements—Statement.
50. Army Prize Money—Account.
52. Trade and Navigation—Accounts.
54. Supply—Account.
66. Railway and Canal Bills—First Report of General Committee.

Delivered on 25th and 27th February, 1865.

37. Bills—Railway Construction Facilities Act (1864) Amendment.
39. ,, Common Law Courts (Fees).
3 (79 to 120). Railway and Canal, &c. Bills—Board of Trade Reports, Parts 79 to 120.
6. Isle of Man Disafforestation—Report.
7. Stock Certificate to Bearer—Paper.
14. Tea, Coffee, &c.—Return.
30. Assaults (Metropolis)—Return.
44. West India Islands, &c. Relief—Account.
59. Malta Docks—Papers.
65 (1). Committee of Selection—Second Report.
66 (1). Railway and Canal Bills—Second Report of General Committee.
73. Private Bills—Rules.
70. Ashantee War—Return.
74. Court of Justice Concentration—Return of the number of Houses to be purchased.

Session 1864.

529. Colonial Bills (North America)—Titles, &c.

Delivered on 28th February, 1865.

25. Bills—Court of Chancery (Ireland) (No. 2).
38. ,, Court of Chancery (Ireland) (No. 3).
41. ,, Writs Registration (Scotland).
42. ,, Game (Ireland).

Patents.

From Commissioners of Patents Journal, March 3rd.

Grants of Provisional Protection.

Artificial stone, manufacture of—441—W. Kirrage.
Beam engines—468—J. G. Jones.
Boats, ships, &c., apparatus for propelling—365—M. Bier.
Books, trimming the edges of—324—W. H. and F. C. W. Latham.
Boots and shoes, manufacture of—291—A. Murray.
Boots and shoes, manufacture of—442—R. A. Brooman.
Bricks, clay for the manufacture of—452—R. Hill and R. Tushingham.
Bricks, making and pressing—480—C. W. Homer.
Casks, lifting and tilting—446—C. O. Staunton.
China and earthenware, ornamenting—435—F. J. Emery.
Collisions at sea, prevention of—445—H. C. and J. Cleaver.
Cylinders, apparatus for lubricating—466—T. Ogden.
Drinking cup, invalid or syphon—437—R. H. Emerson.
Envelopes, apparatus for folding—479—J. D. Nichol.
Envelopes, fastener for—495—H. P. Ribton.
Fibrous materials, preparing—376—E. Lord.
Fibrous materials, spinning and carding—90—R. Tempest.
Filters—467—R. A. Brooman.
Fire-arms, breech-loading, cartridge boxes for—254—E. Blakeslee.
Fire-arms, revolving—309—S. W. Wood.
Glass, ornamented articles of—497—T. G. Webb.
Hats, apparatus for ventilating—498—J. Carter.
Highways, &c., machine for clearing, sweeping, &c.—444—H. J. Picard.
Illusory exhibitions, apparatus for—222—J. H. Pepper and T. W. Tobin.
Iron, manufacture of—470—W. Robinson.
Iron or steel chains, making the links of—422—G. Homfray.
Iron safes and strong rooms—499—G. N. Shore.
Ladies' stays, lacing and fastening—351—C. Field.
Leather, composition as a substitute for—465—C. Brakell, W. Hoehl, and W. Gunther.
Leather, &c., machinery for sewing—484—C. Baulch.
Lime, preparation of superphosphate of—320—W. E. Newton.
Liquids, measuring the specific gravity of—448—J. F. Hearsey.
Magnesium, manufacture of—456—J. O. Christian, and J. and H. Charlton.
Ordnance, breech-loading—372—A. Krupp.
Oxalic acid—449—F. A. Laurent, J. Cathelaz, and N. Basset.
Pen and pencil holders—394—E. J. Hill.
Potash and soda, sulphates and carbonates of—460—C. F. Claus.
Railway carriages, &c., electro-magnetism as a break power to—101—F. Barnes, D. Hancock, and E. Cowpe.
Railway carriages, signalling by the passengers to the guard of—290—E. Whittaker.
Railway passengers, &c., apparatus for the protection of—472—L. W. G. Rowe and A. Baab.
Railway passengers, securing the safety of—454—C. Defries.
Railway rails—434—D. C. Pierce.
Railway signalling, electro-magnetic apparatus for—488—C. V. and A. O. Walker.
Railway trains, communication between passengers and guards, by night or by day—289—J. W. Gray.
Railway trains in motion, shifting points on—474—G. H. H. Ware.
Railway trains, machinery for stopping—487—E. Jesurum.
Roadways, pavements, &c., construction of—335—C. Henderson.
Safes—450—J. Thompson.
Sash fasteners—482—W. Hitchin.
Scarfs—491—I. Pariente.
Sewage, treatment of—451—R. Smith.
Sewing machines—475—H. Percy.
Solid substances, extracting liquid from—486—W. E. Newton.
Steam engines—166—W. C. Hicks.
Steam engines—485—J. R. Swann.
Steam ploughing—366—R. Winder.
Stoppering bottles—414—W. C. Hine.
Valve, balanced slide—496—W. E. Newton.
Vessels of war, armour plates for—455—J. Brown.
Volatile liquids, apparatus for distilling—447—W. E. Newton.
Water, boilers for heating—493—J. Hulley.
Working ships' pumps—303—M. Blank.

Inventions with Complete Specifications Filed.

Paper collars—556—S. S. Gray.
Rifle, magazine repeating and breech-loading—540—E. H. Eldredge.
Vehicle for teaching children to walk—537—J. Askew.

Patents Sealed.

2178. T. H. Baker and T. Woodroffe.
2179. J. Smith.
2190. P. E. Placet.
2195. G. Bedson.
2197. D. Fruwirth.
2199. T. Wilson.
2203. H. D. P. Cunningham.
2207. P. W. Barlow.
2219. C. Moriarty.
2220. A. Watt.
2236. J. H. Ritchie, jun.
2333. P. Barr.
2347. A. H. P. S. Wortley and W. W. Vernon.
2504. H. Tucker.
2530. J. Batkin.
2547. J. Hayes.

From Commissioners of Patents Journal, March 7th.

Patents Sealed.

2204. H. C. Lobnitz.
2205. T. Restell.
2214. T. D. Ridley.
2225. D. C. Knab.
2226. G. Clark.
2232. E. Higham and R. Kirk.
2234. J. M. Fisher.
2248. R. Townsend.
2258. J. G. Hey.
2860. J. Gothard and H. Garland.
2885. W. Clark.
3029. W. E. Newton.
3092. C. Hancock & S. W. Silver.
3093. C. Hancock & S. W. Silver
3094. C. Hancock & S. W. Silver.
3110. C. Hancock & S. W. Silver.

Patents on which the Stamp Duty of £50 has been Paid.

555. J. Sim.
557. M. Dodds.
692. R. A. Brooman.
582. W. Conisbee.
612. J. Fowler, jun., D. Greig, and R. Noddings.
613. T. and W. Ball, and J. Wilkins.
562. A. E. Ragon.
625. J. Platt and W. Richardson.
596. W. Tongue.
604. J. Barker.

Patents on which the Stamp Duty of £100 has been paid.

450. R. S. Bartlett.
466. B. B. Stoney.
423. W. H. Graveley.

Registered Designs.

Fastener and Protector for the Pin of Brooches and other similar Dress Fastenings—Feb. 11—4692—J. R. Hayes, Birmingham.
Bit for Horses—Feb. 15—4693—W. and G. Ashford and Winder, Birmingham.
Lid or Cover of Box Irons—Feb. 22—4694—Enoch Siddaway, West Bromwich.
Bottle Jack—Feb. 22—4695—Farrow and Jackson, 18, Great Tower-street, City.
Gas Carbonising Apparatus—Feb. 24—4696—W. Oxley and Co., St. Mary's Churchyard, Parsonage, Manchester.
Gentleman's Turn-down Collar—Feb. 24—4697—R. Sinclair and Co., 80, Wood-street, City.
Improved Spur Stud Socket and Plug—March 1—4698—W. Evans, Hyde-park Barracks, W.
Antifriction Band for Boots and Shoes—March 4—4699—W. Hallam and R. H. Southale, Birmingham.
Safety Bar for Outside Doors—March 6—4700—Walter Sandell Mappin, Birmingham.